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FURTHER STUDIES ON THE MECHANISM OF LABOR*

W. E. CALDWELL, M.D., F.A.C.S., H. C. MOLOY, M.Sc., M.D., AND D. ANTHONY D'ESOPO, PH.B., M.D., NEW YORK, N. Y.

(From the Department of Obstetrics and Gynecology, Columbia University and the Sloane Hospital for Women)

THE investigation which was instituted by one of us (W. E. C.) at the Sloane Hospital for Women over three years ago had, as its chief objective, the anatomic elucidation of the mechanism of labor and the explanation of the more common causes of arrested labor. The form of the pelvis received first consideration, chiefly because it lends itself more readily to roentgenologic visualization than other factors concerned in labor. In two recent communications the observations were described in detail, at which time a new classification of the female pelvis was proposed.[1, 2] Last year in a third publication we described the use of roentgenologic methods of examination early in labor to determine the frequency of occurrence of anterior, transverse, and posterior positions of the fetal head at the inlet in relation to the pelvic type in a consecutive series of 215 primigravida women and at the same time described the common method of engagement of the fetal head.[3]

The principles worked out during these preliminary studies have been most helpful in the present investigation of the mechanism of

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labor throughout the lower levels of the pelvis. No attempt is made to give statistical data in this paper. Instead, we are describing what to us are some of the outstanding observations in the careful study of over 1,000 complete roentgenologic examinations of the pelvis and fetal head obtained before, during, or after labor in conjunction with the known details of the actual delivery and the facts ascertained by vaginal examination.

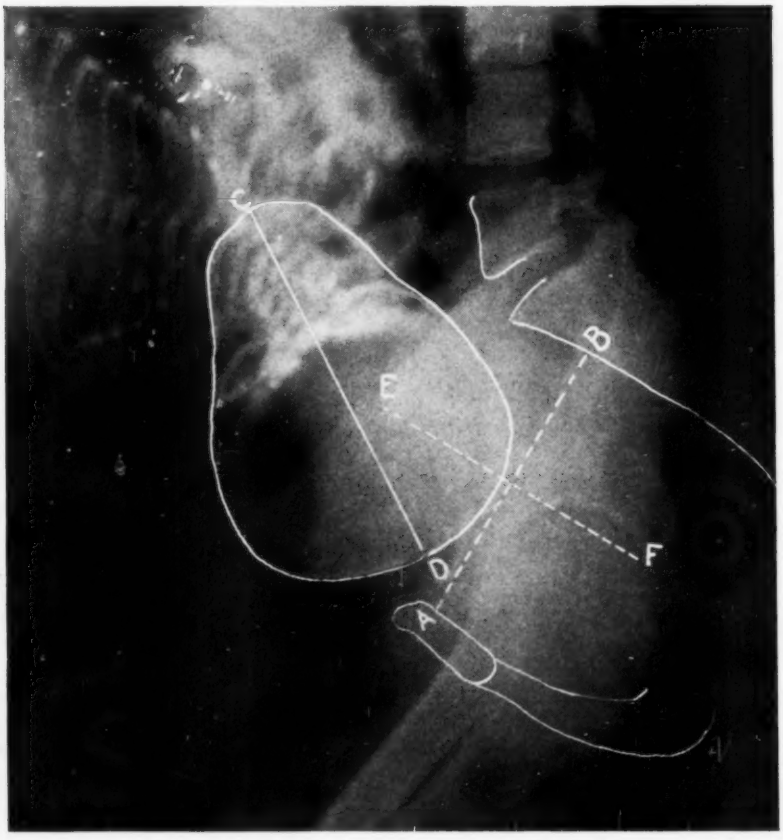

Fig. 1.—Lateral roentgenogram early in labor. *A. B.*, First plane of inlet and true conjugate diameter. *C. D.*, Long axis of fetal head. *E. F.*, Perpendicular to inlet through midpoint of true conjugate diameter. Extreme posterior parietal position at inlet. Such a marked degree is rare. Note relationship of *C. D.* to *E. F.* and *A. B.*

Careful study of the lateral roentgenograms illustrated in Figs. 1 to 7, in which the fetal head and its long axis (*C. D.*), the true conjugate (*A. B.*), and a perpendicular through its midpoint (*E. F.*), as well as the pubic and sacral boundaries of the true pelvis from the lateral aspect have been outlined, will bring out several important points relating to the entire mechanism of labor. These facts are separately dealt with in greater detail later in the text.

The marked obliquity of the long axis of the fetal head to the true conjugate diameter or its perpendicular, illustrated in Figs. 1 and 2, accounts for the positions assumed by the vertex in extreme examples of a posterior and anterior parietal

position. In Figs. 3 and 4 the more usual degree of obliquity is shown. The long axis of the head, however, is still at an angle to the inlet. With engagement and descent into the true pelvis a marked change in the direction of the long axis of the head occurs, and in Figs. 5 and 6 it will be noted that *C. D.* is now directed downward and backward away from the perpendicular *E. F.* The axis of the head in Fig. 5 is directed posteriorly forming a wide angle to *E. F.*, and in Fig. 6 the head has descended to a low level with its long axis parallel and close to the sacrum. After

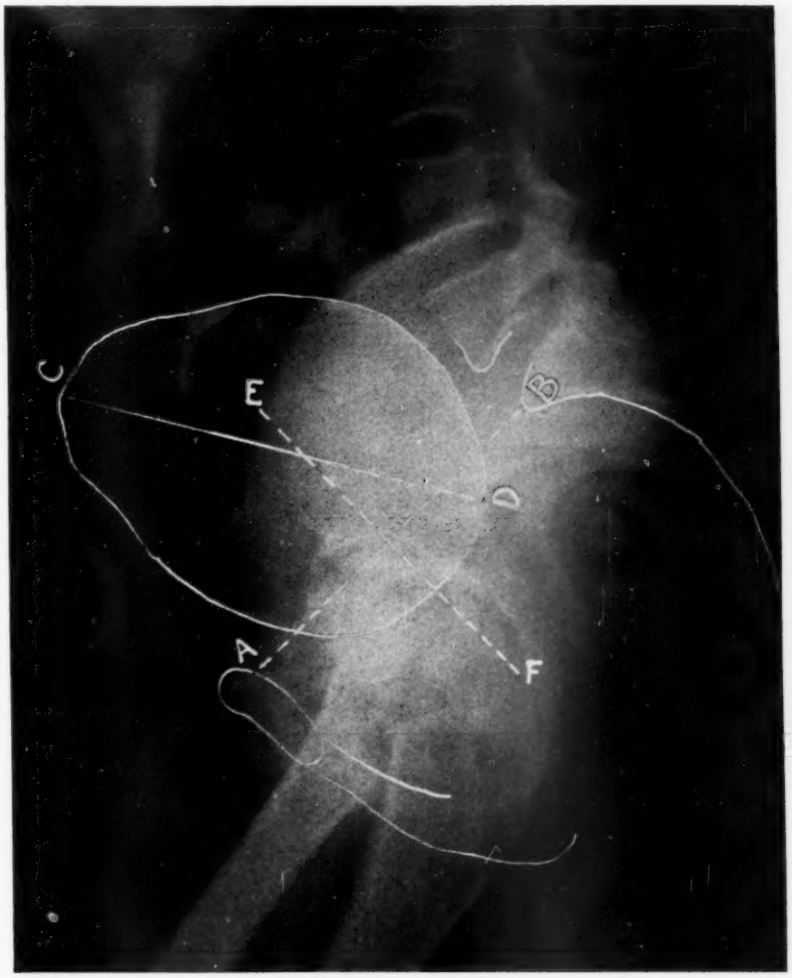

Fig. 2.—Lateral roentgenogram early in labor. *A. B.*, First plane of inlet and true conjugate diameter. *C. D.*, Long axis of fetal head. *E. F.*, Perpendicular to inlet through midpoint of true conjugate diameter. Extreme anterior parietal position, so rare in this degree as to be considered an obstetrical curiosity. Note relationship of *C. D.* to *E. F.* and *A. B.*

rotation has occurred and the vertex has descended into the lower fore pelvis (Fig. 7), the axis of descent again shows no relationship to the perpendicular of the inlet, but seems obviously parallel with the symphysis and descending rami of the pubes. It will be observed that the perpendicular to the true conjugate *E. F.* serves merely as an axis of reference from which the angular relationship of the long axis of the head within the true pelvis may be determined.

The extreme example of the posterior parietal position or the so-called Litzmann's or Varnier's obliquity, illustrated in Fig. 1, is quite rare, but the lesser degree of the same obliquity, as illustrated in Fig. 3, represents in our experience the common position at the time of engagement. As descent occurs from this or any position into the true pelvis, the long axis of the fetal head swings downward and backward, while the fetal axis is carried forward until the line of descent,

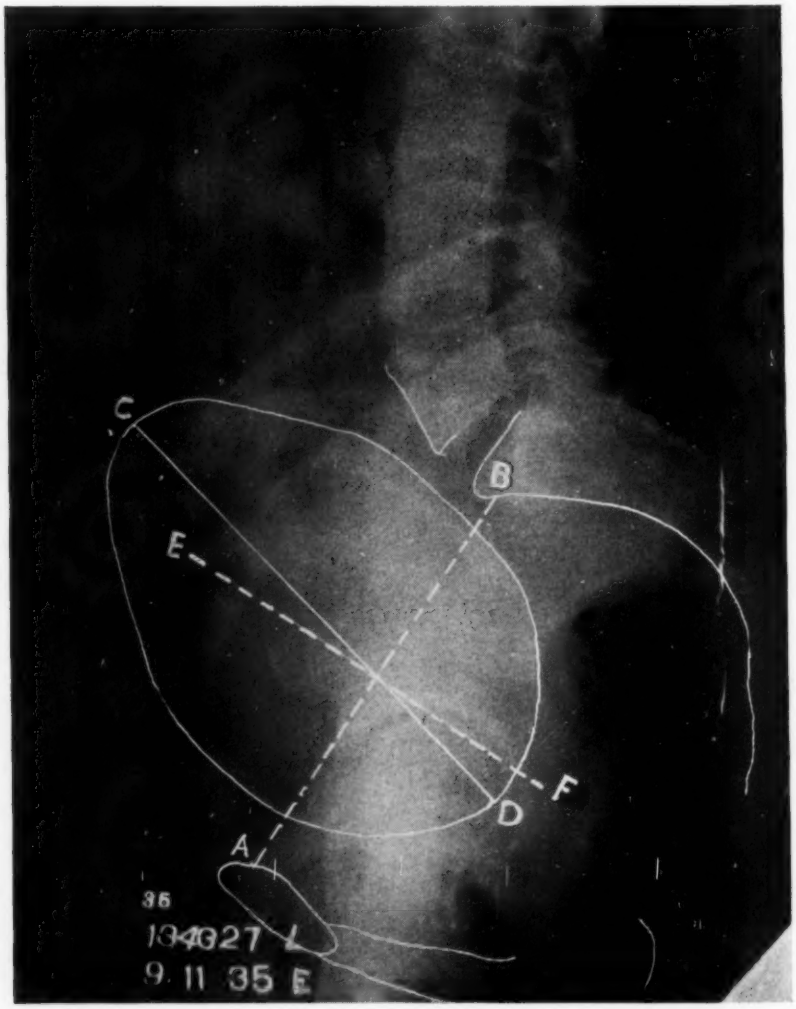

Fig. 3.—Lateral roentgenogram early in labor. *A. B.*, First plane of inlet and true conjugate diameter. *C. D.*, Long axis of fetal head. *E. F.*, Perpendicular to inlet through midpoint of true conjugate diameter. The usual degree of a posterior parietal position at the inlet. This degree of asynclitism is the average at engagement. Note that *C. D.* slopes forward to *E. F.* pointing into fore pelvis.

having crossed behind the perpendicular of the inlet, points toward the bottom of the posterior pelvis as represented by the anterior surface of the lower sacrum (compare Fig. 3 with Figs. 5 and 6). This curve of descent from the upper fore pelvis to the bottom of the posterior pelvis necessitates that the posterior parietal bone and sagittal suture, originally felt near the symphysis, is carried downward

and backward, becoming less easily palpable, while the anterior parietal becomes more accessible to the examining finger as the level of the midpelvis is approached. Though the head is constantly adapting itself to the pelvis, the chief factors which cause rotation become operative at this level. Synchronous with rotation, the head descends and moves forward along the inclined muscular plane of the lower fore pelvis until the back is close to and parallel with the symphysis.

The typical anterior parietal position or Nägele's obliquity, in which the sagittal suture points toward the promontory of the sacrum as in Fig. 2, in our experience is so rare as to be considered almost an obstetric curiosity. Lesser degrees of the

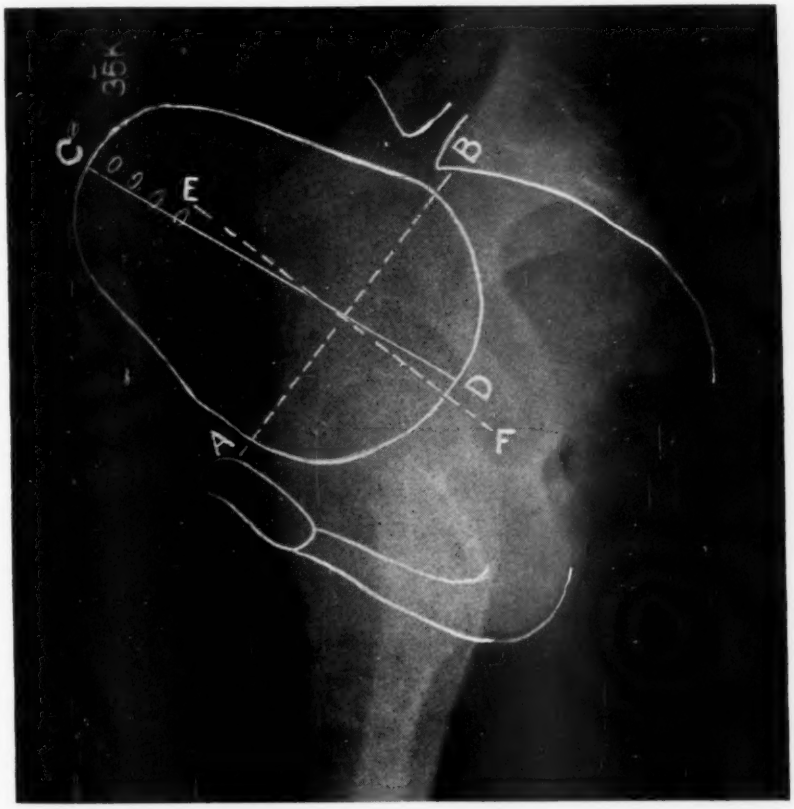

Fig. 4.—Lateral roentgenogram early in labor. *A. B.*, First plane of inlet and true conjugate diameter. *C. D.*, Long axis of fetal head. *E. F.*, Perpendicular to inlet through midpoint of true conjugate diameter. A relatively rare, but no uncommon form of an anterior parietal position at the inlet. Note that *C. D.* is almost perpendicular to the inlet but is inclined slightly behind *E. F.* This tendency is more noticeable when the fetal spine is located and found to be in front of the perpendicular *E. F.*

same position, as illustrated in Fig. 4, are somewhat more frequent, but when such a position is found, it is usually associated with a sagging forward of the uterus, carrying with it the body of the fetus. If the relationship of *C. D.* to *E. F.* is closely studied in Fig. 4, it will be noted that, although the head is, to all intent and purpose, perpendicular to the inlet *A. B.*, its long axis *C. D.* points slightly behind *E. F.* This minor anterior parietal tendency becomes more obvious when the long axis of the head is associated with the line of the fetal vertebral column, when it will be found that the fetal axis is definitely in front of the perpendicular of the inlet. The axis of descent, under these circumstances, is straight downward

and backward in the line of the long axis of the fetal head *C. D.* until at a low level in the posterior pelvis the head is found almost parallel to the sacrum as in Fig. 6. The principle of descent is similar for both these minor posterior and anterior parietal tendencies at the inlet. The posterior parietal tendency necessitates that the long axis of the fetal head *C. D.* cross behind the perpendicular in conjunction with a forward movement of the uterus in labor. In the case of an anterior parietal tendency, or with any head which at the onset of labor is fitting squarely in the inlet,

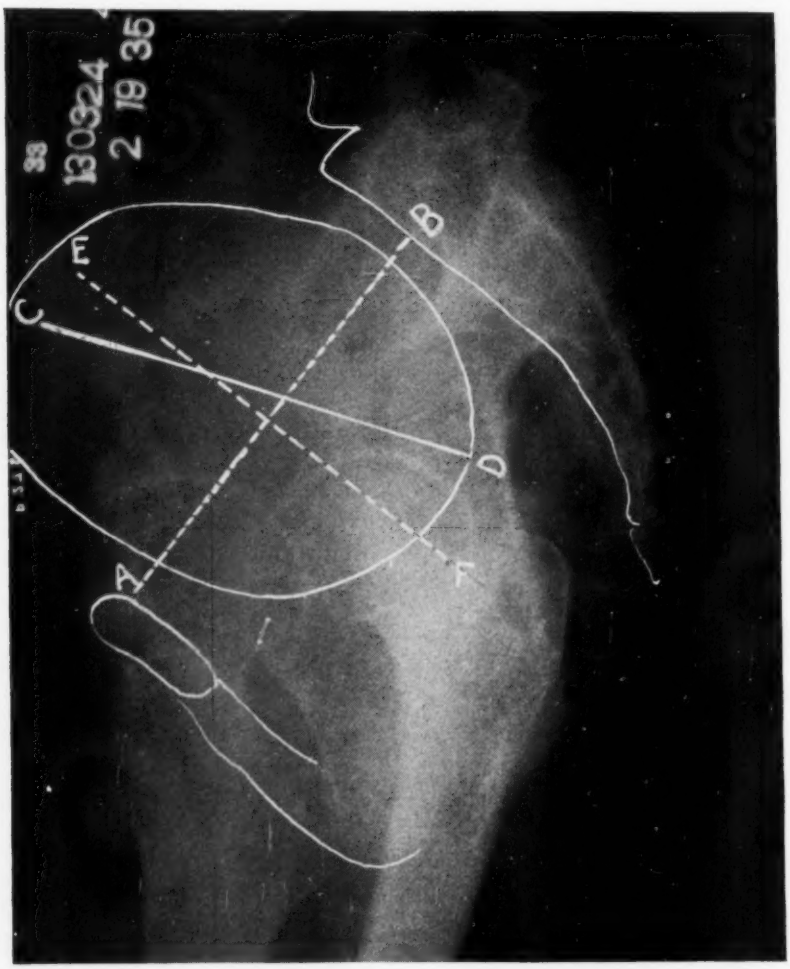

Fig. 5.—Lateral roentgenogram in labor. *A. B.*, First plane of inlet and true conjugate diameter. *C. D.*, Long axis of fetal head. *E. F.*, Perpendicular to inlet through midpoint of true conjugate diameter. Engagement has occurred. Note that the long axis of head *C. D.* is directed against sacrum behind *E. F.*, having engaged from a posterior parietal position.

the first part of this movement is unnecessary (compare Figs. 3 and 4). For both, the normal line of descent is one which carries the head downward and backward, ultimately at or behind the perpendicular of the inlet to the bottom of the posterior pelvis close to the lower aspect of the sacrum.

What factors may be suggested in explanation of this method of engagement? A study of the relationship of *E. F.* to *C. D.* in Figs. 5 and 6 will indicate that

this posterior curve of descent can scarcely be considered primarily due to the static pelvis, because in Fig. 5 the long axis of the head at that particular level is directed against the sacrum, not parallel with it as in Fig. 6. We believe that the lower pole of the uterus plays an important directing rôle in this mechanism, in conjunction with a forward movement of the uterus and the fetal axis.

Another important point which needs further explanation concerns the particular static axis followed by the head through the pelvis. The region used consistently by

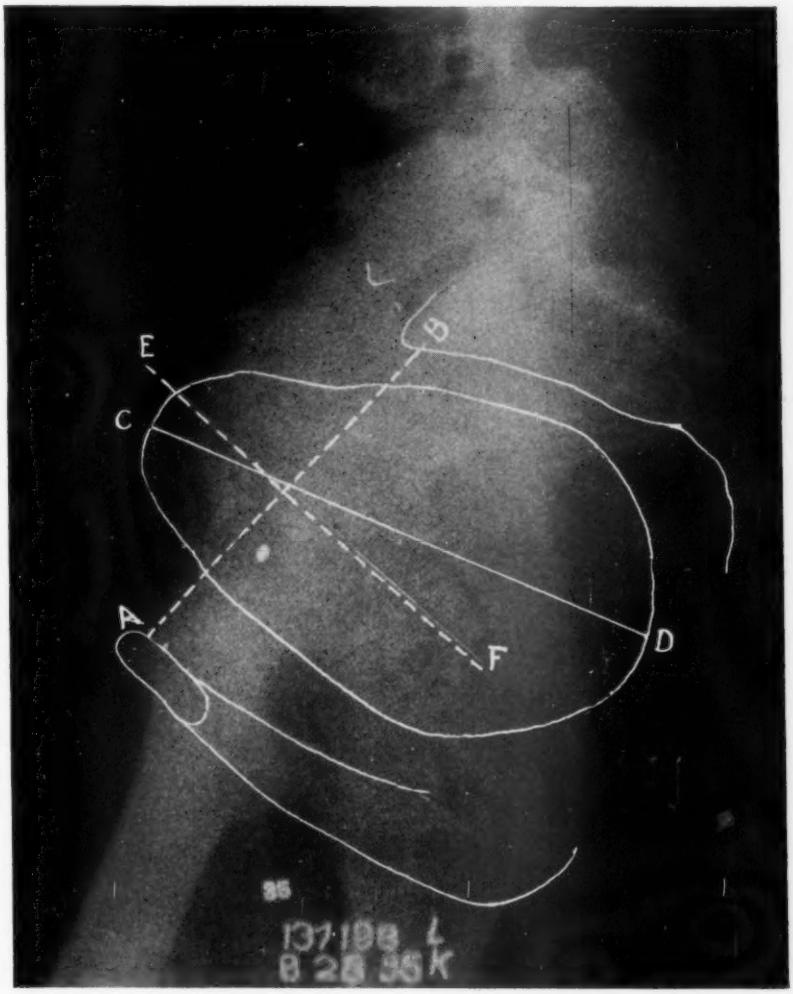

Fig. 6.—Lateral roentgenogram in labor. *A. B.*, First plane of inlet and true conjugate diameter. *C. D.*, Long axis of fetal head. *E. F.*, Perpendicular to inlet through midpoint of true conjugate diameter. Engagement has occurred. Note that *C. D.* is parallel to sacrum and behind *E. F.* In this case, engagement occurred from a slight anterior parietal position as in Fig. 4.

the head in all pelves is indicated to advantage in Fig. 55. In all pelves, the widest transverse diameters are located behind the midpoint of the anteroposterior diameter. In order that the head may make consistent use of this more ample region, the lower pole of the uterus guides it into the posterior pelvis close to the sacrum and offers a restraint which prevents it from encroaching too soon on the fore pelvis where

narrower diameters may exist. In Fig. 55, it will be observed that the major portion of the head is located behind and above the ischial spines. The fore pelvis is avoided. Thus the central axis of the superior strait is too far forward in the pelvis to represent the axis followed by the head through the true pelvis. This latter axis of the posterior pelvis is illustrated in Fig. 24 (*C. D.*).

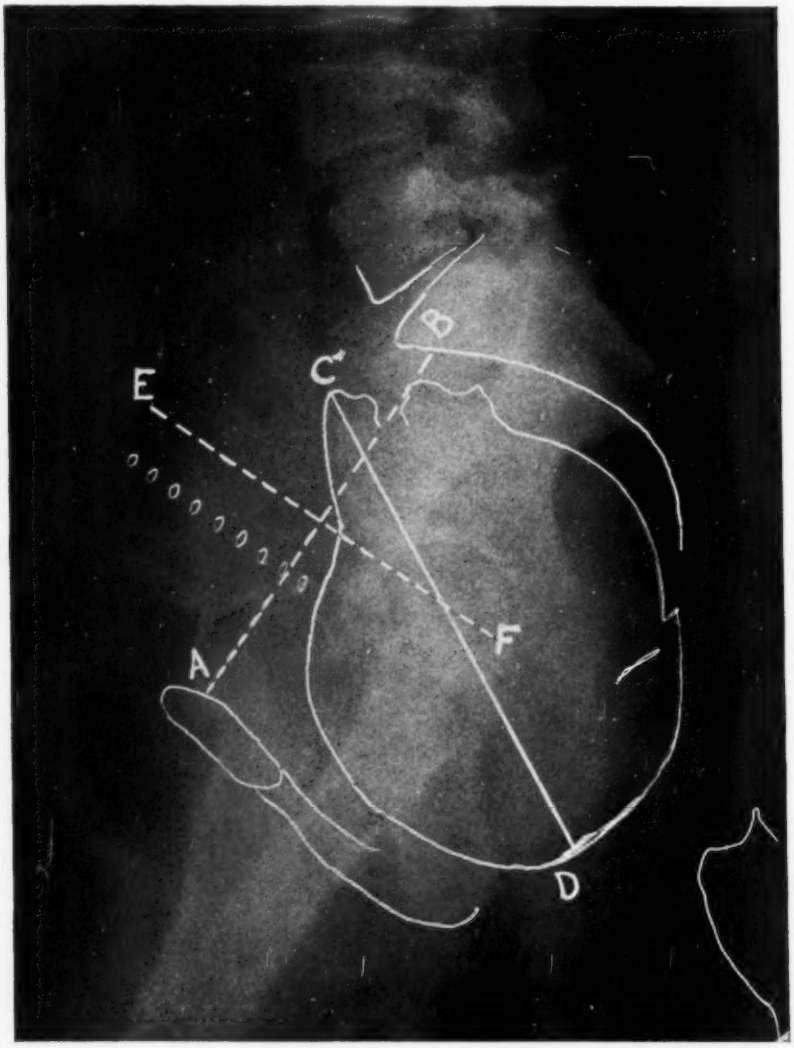

Fig. 7.—Lateral roentgenogram late in labor. *A. B.*, First plane of inlet and true conjugate diameter. *C. D.*, Long axis of fetal head. *E. F.*, Perpendicular to inlet through midpoint of true conjugate diameter. Head in fore pelvis with back anterior and parallel to symphysis. Long axis of head *C. D.* points into upper posterior pelvis. Fetal back in advance of *E. F.* in axis of fore pelvis (see *G. F.*, Fig. 24).

In these roentgenograms it will also be observed that the anterior boundary of the fore pelvis is not the width of the symphysis alone, as usually accepted, but includes the entire depth of the fore pelvis consisting of the posterior aspects of the symphysis and the pubic rami. The true pelvic cavity, therefore, actually approaches the form of a parallelogram, in which the anterior bony boundary is comparable in length to the pelvic surface of the sacrum posteriorly.

The above findings illustrated in Figs. 1 to 7, obtained by repeated stereoroentgenograms and large lateral films of the pelvis during labor, have occurred so consistently in normal labor as to be interpreted by us as the usual or average method of descent. To explain fully the mechanism of labor, other factors besides those of the planes and axes of the static pelvis have to be taken into account. There is, for instance, the axis of the uterus proper and its lower pole; also the muscular and ligamentous gutter of the pelvic outlet. All of these and other points will be considered in detail under the following heads:

1. Relationship of the bony inlet to the outlet as influencing the mechanism of labor.

2. A discussion of the points of origin of the true conjugate diameter at the inlet in relation to the various planes and axes of the pelvis.

3. The axis of the uterine soft parts in the upper pelvis; the soft parts of the lower pelvis and their significance.

4. The axis of the true pelvis as revealed by this investigation, and as compared to the accepted conception of the pelvic axis.

5. The normal mechanism of labor described and illustrated, showing the application of the principles described.

6. The manner in which the abnormal pelvis may modify this normal mechanism will be limited to a discussion of the following: (a) The mechanism of labor in android (male) types. (b) Fetal pelvic adaptation at the inlet in relation to the shape of the inlet. (c) The type of pelvis associated with the persistent posterior position.

1. RELATION OF THE BONY INLET TO THE OUTLET

This investigation of the mechanism of labor, which virtually represents the clinical application of our previous studies on the variations in pelvic architecture, has been gratifying in two ways. It has substantiated the accuracy of the original anatomic description of each of the four parent types, the gynecoid, android, anthropoid, and platypelloid forms. And it has made it possible to observe the ease with which the shape of the pelvis may be correlated to the mechanism of labor.

The widest transverse diameter of the inlet is used to divide the inlet into an anterior and posterior segment, each of which displays a characteristic shape for the four parent pelvic types, Figs. 8 to 11. We have noticed that this diameter bears a very important relationship to the interspinous diameter situated at a lower level in the pelvic outlet. *These two diameters so closely approach the same transverse vertical plane that for practical purposes one may be considered either perpendicularly below or perpendicularly above the other, as the case may be.* This relationship is noted consistently when the skeletal pelvis is viewed with the plane of the inlet (later to be described) held so that the line of vision is directed at right angles to the point of intersection of the transverse and anteroposterior diameters of the inlet (Fig. 12, note perpendicular relationship between *C. D.* and C^1 D^1).

Thus a transverse section of the pelvis through its widest transverse diameter and the ischial spines divides the pelvis into an an-

terior and a posterior segment. The anteroposterior diameters of each segment are termed the "anterior" and "posterior" sagittal diameters for all levels, Figs. 12 and 13, A^1 and B^1. In practice, however, the inlet or the outlet represents the common level at which a knowledge of these diameters is most significant. The anterior sagittal is almost invariably longer than the posterior sagittal diameter for both the inlet and the outlet. In fact, in certain forms of android types

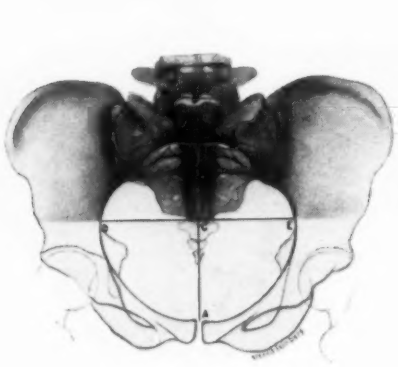

Fig. 8.

Fig. 9.

Fig. 8.—Gynecoid type. For each pelvic type, Figs. 8 to 11, note that the widest transverse diameter *D. E.* intersects the anteroposterior diameter *A. B.* at *C.*, dividing the latter into two parts: the anterior sagittal diameter *A. C.* and the posterior sagittal *C. B.* Note the variation in length of each in the four parent types. The perpendicular relation of the widest transverse of the inlet and the interspinous diameter cannot be illustrated due to the slight tilt of the inlet.

Fig. 9.—Anthropoid type. (See legend under Fig. 8.)

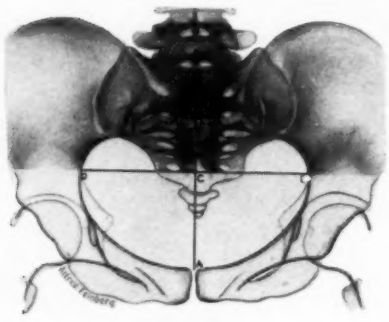

Fig. 10.

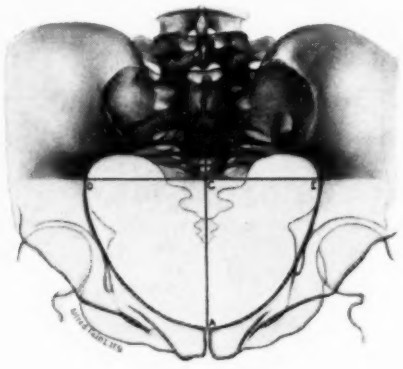

Fig. 11.

Fig. 10.—Platypelloid (flat) type. (See legend under Fig. 8.)

Fig. 11.—Android type. (See legend under Fig. 8.)

with anthropoid tendencies, the true conjugate diameter consists chiefly of the anterior sagittal diameter. The characteristic variations in the length of both sagittal diameters at the inlet for each of the four parent pelvic types are illustrated to advantage in Figs. 8 to 11. *In any individual pelvis the length of each is maintained from inlet to outlet, Fig. 13,* A^1 $B.^1$ This point is particularly important

in regard to a clear understanding of the capacity of the anterior and posterior pelvis at the outlet.

Having established this principle and observed that it holds for all types of pelves, it remains to inquire into the manner in which such established obstetric measurements as the anterior and posterior sagittal diameters of the outlet (Klien) are affected. Note that the anterior sagittal diameter (Klien), Fig. 13, *E. F.*, is really an index

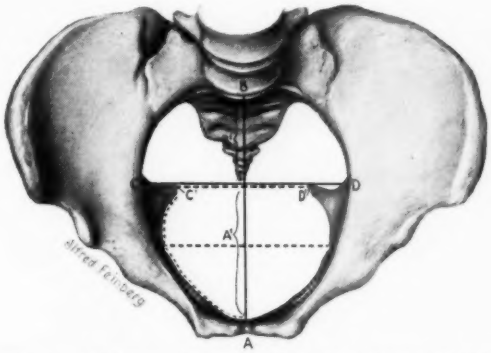

Fig. 12.—Inlet view: Relation between inlet and lower pelvis. Principles apply to all types (anthropoid type illustrated). The widest transverse diameter of inlet *C. D.* is directly above the interspinous diameter C^1 D^1. The intertuberous diameter is in front of and considerably below the interspinous diameter and almost invariably longer. The anterior sagittal diameter A^1 is longer than the posterior sagittal B^1.

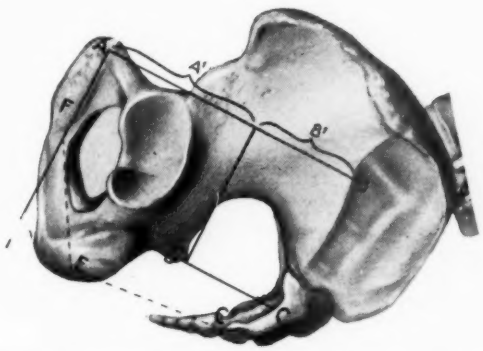

Fig. 13.—Lateral view of Fig. 12. The anterior sagittal A^1 and the posterior sagittal B^1 are preserved from inlet to outlet and represent the true index to pelvic capacity for anteroposterior diameters throughout the pelvis. Modified only by variations in the subpubic arch and lower sacral region. Note that the anterior sagittal of Klien *E. F.* represents an index to the perpendicular length of the ischiopubic rami, while the posterior sagittal of Klien *F.* C^1 is not as reliable an index to posterior pelvic capacity as the length of B^1 at higher levels.

to the perpendicular length of the pubic and ischial rami and, therefore, of little obstetrical significance. The capacity of the lower fore pelvis is primarily dependent on the transverse diameters in this region (Figs. 16 to 19). Any measurement of the posterior sagittal diameter of Klien at the outlet cannot be accepted as a reliable index to posterior pelvic capacity at higher levels (Fig. 13, *E.* C^1). This diameter may be decreased by a forward curvature of the sacral tip

in a normal pelvis to the same degree as it is shortened in an extreme android type, in which the head would be arrested at the inlet. Or again, an increase in the length of the posterior sagittal diameter of Klien may infer either a long anthropoid type of posterior segment in the posterior pelvis or a straight sacrum which is inclined backward. In this latter case, the posterior segment at the inlet may conform to any type. In other words, we are stressing the importance of associating the outlet diameters with the pelvis as a whole in establishing a working prognosis in regard to the mechanism of labor.

In order that the length of the anterior and posterior sagittal diameters of the inlet, as described, may be maintained throughout the pelvis, the sacrum must possess a normal curvature and inclination posteriorly, while the symphysis and pubic rami anteriorly must approach closely the same parallel plane and become straight. Fortunately, this desirable anatomic relationship usually obtains, but this

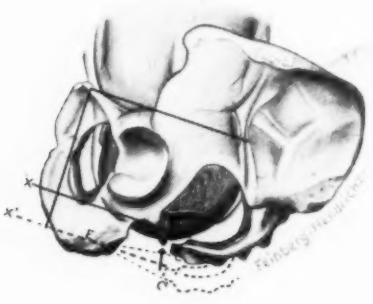

Fig. 14.

Fig. 15.

Fig. 14.—Lateral view. Posterior pelvic capacity at the outlet as modified by lower sacral variations. C^1 forward curvature of sacrum at low level. Compensatory space directly forward at X^1 in lower aspects of subpubic arch. C represents elevation of forward sacral tip toward region of ischial spine. Loss of compensatory space directly forward at X, since subpubic arch narrows rapidly toward symphysis in this region. Note that differences in posterior sagittal of Klien, *E. C.* and *E. C'*, give no reliable index to the change in level of sacral tip. Resistance offered head by sacral tip hinders the normal dilatation of cervix (see arrows).

Fig. 15.—Lateral view of fore pelvis. In addition to a decrease in transverse diameters in lower fore pelvis (see Figs. 16 to 19), the deviation of plane of the pubic rami behind the plane of the symphysis may modify lower pelvic capacity in the fore pelvis.

rule is not invariable. It is the departures from the normal which can be expected to modify the mechanism of labor. In the posterior pelvis, lower sacral variations, such as an acute forward inclination or curvature, will decrease the outlet capacity. When this occurs, it is not so much the extent of the forward swing of the sacral tip as it is the amount of elevation of the lower sacral region in relation to the ischial spines, Fig. 14. If the sacrum curves forward at a low level, the mechanism of labor need not be affected materially unless the general pelvic type is distinctly abnormal. The head can descend to this low level where it may utilize, when it moves into the fore pelvis, the space afforded by the widest part of the subpubic

arch at a point directly in front of the lower sacral region. If, however, considerable elevation of the lower sacral area in relation to the ischial spines is present, a bony platform is created in the posterior pelvis which may cause arrest of the head at a higher level. In this case the head cannot move forward because no compensatory space exists directly in front in the narrower upper portion of the subpubic angle. At this higher level, the pubic rami converge toward the under surface of the symphysis and offer a more solid bony resistance to the lateral aspect of the fetal head when any attempt is made to direct

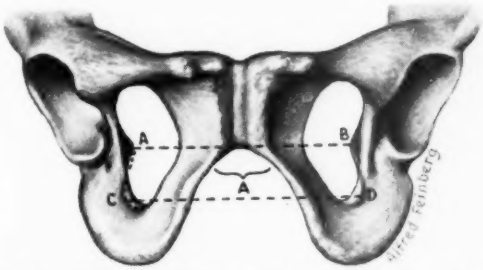

Fig. 16.—A narrow subpubic arch similar in size to Fig. 18. Note wide interspinous (*A. B.*) and intertuberous diameters (*C. D.*).

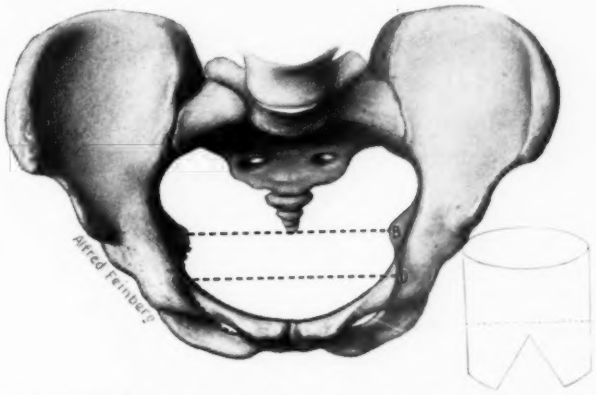

Fig. 17.—Inlet view of pelvis in Fig. 16. Typical android type. Observe that the interspinous (*A. B.*) and intertuberous diameters (*C. D.*) are long and the side walls converge *in front* of the latter to form a narrow subpubic arch. As a result, the entire fore pelvis is well formed in spite of the narrow subpubic arch (Fig. 16).

the head into the fore pelvis. For each of the two levels of the sacrum illustrated in Fig. 14, the length of the posterior sagittal diameter of Klien (*E. C.* and *E. C*[1]) would give no reliable index to the degree of sacral elevation or the type of obstetrical difficulty encountered.

Labor in pelves with a forward curvature of the lower sacral region is complicated frequently by failure of the cervix to dilate and retract normally. The cause for this cervical difficulty is explained in Fig. 14. The head, meeting the resistance of the lower sacrum and coccyx (ar-

rows), is unable to descend far enough at the height of each contraction to bring pressure to bear against the dilatable cervix. As a result, dilatation ceases usually with an appreciable rim of cervix around the head. This abnormality illustrates a principle in the normal dilatation and retraction of the cervix. For this to occur, the head must be permitted to descend with each contraction unobstructed by the bony pelvis at any point, in order to make proper pressure against the cervix and then to recede to a higher level through the elastic recoil of the soft parts as the contraction subsides.

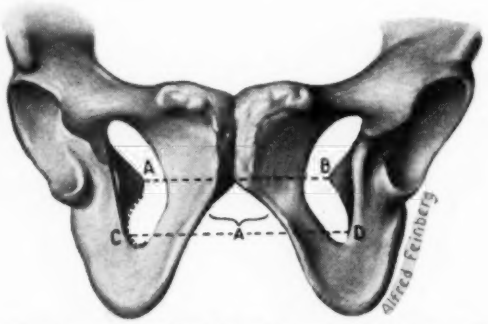

Fig. 18.—Front view of narrow subpubic arch comparable in size to Fig. 16. Note narrow interspinous (*A. B.*) and intertuberous diameters (*C. D.*).

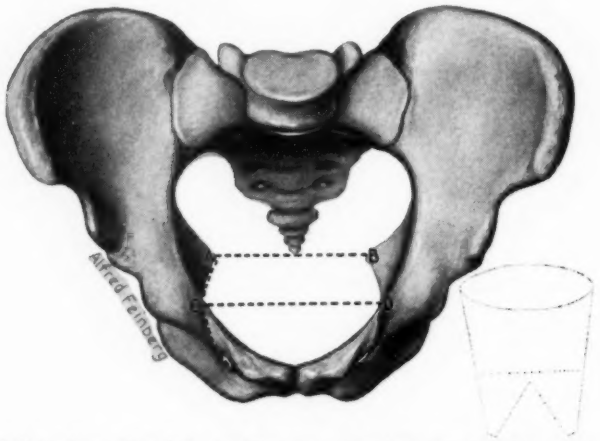

Fig. 19.—Inlet view of pelvis in Fig. 18. Typical anthropoid type. The lateral pelvic walls converge to the narrow arch, causing a decrease in both the interspinous (*A. B.*) and intertuberous diameters (*C. D.*). Thus, Figs. 16 to 19 show that the size of the subpubic arch gives no indication of the type of pelvis which may be associated with it.

Invariably, the anterior sagittal diameter in the midline is maintained from inlet to outlet. Pelvic capacity in the fore pelvis is affected chiefly by a decrease in the transverse diameters in front of the ischial spines, Figs. 16 to 19. Marked deviation of the plane of the pubic rami behind the plane of the symphysis, however, represents a condition which occurs frequently in narrow fore pelves, Fig. 15. Under such circumstances, the pubic and ischial rami not only

hinder rotation but prevent the occiput from attaining the position close to the posterior plane of the symphysis, so essential for descent in the axis of the fore pelvis. Accordingly, the head must descend through the narrow fore pelvis in an axis more posterior to the usual axis, thus forcing it against the coccyx and resistant sacrospinous ligaments of the lower posterior pelvis.

At the inlet, when the widest transverse diameter is narrow, the pelvis, as a rule, is anthropoid in type with characteristic effects on the mechanism of labor. Likewise, narrowing of the interspinous diameter at the outlet will exert a characteristic influence in hindering the normal rotation of the fetal head, since this diameter has the same relation to the outlet as the widest transverse diameter bears to the inlet. But narrowing of this diameter does not imply that the pelvis conforms to any special type, because definite narrowing may occur at the interspinous diameter in any type of pelvis, and it is the presence or absence of convergence of the side walls from the inlet which is especially important, i. e., whether the convergence is present in the region of the ischial spines or more anterior in the fore pelvis (see Figs. 16 to 19).

The relationship of the interspinous to the intertuberous diameter must also be considered. *The intertuberous diameter is always in front of the interspinous and at a considerably lower level, Fig. 12. Also, almost invariably the intertuberous is wider than the interspinous.* This fact makes the interspinous diameter, rather than the intertuberous, the index to transverse capacity in the lower pelvis. It must be realized, of course, that the intertuberous and interspinous diameters may be normal in size and yet an abnormality may exist at the inlet on which the prognosis depends.

No description of the abnormal pelvis is complete without reference to the narrow subpubic angle. As we had occasion to study more cases with a complete roentgenologic and obstetric work-up, we began to observe that patients with a narrow subpubic angle would frequently deliver normally without extensive laceration, while others encountered more serious difficulty. It became obvious that the size of the subpubic angle in itself represented no reliable index to the ease or difficulty encountered, even when narrowing existed. The first important factor has already been referred to in that the basic pelvic type is important. If the posterior sagittal diameter at the inlet (as in android types), is short, this shortening is carried down through the pelvis, so that the index to the capacity of the posterior pelvis is the measurement at the inlet rather than the length of the posterior sagittal diameter of Klien at the outlet. The other factors are the length of the intertuberous and interspinous diameters

and the point of maximum convergence of the side walls. These features are illustrated in Figs. 16 to 19. Both pelves illustrated possess equally narrow subpubic angles. The type of pelvis, however, behind the subpubic angle is radically different in the examples illustrated, and each pelvis predisposes to a radically different mechanism of labor. Note that the pelvis in Figs. 16 and 17 (front and inlet views) represents a typical android with a wide interspinous and intertuberous diameter, but the fore pelvis converges rapidly in front of the latter diameter to form the narrow subpubic arch. Thus, the fore pelvis of this example is well formed and ample, in spite of the narrow pubic arch. In this case, an average-sized child was delivered spontaneously after a shallow episiotomy. The pelvis in Figs. 18 and 19, however, conforms to the anthropoid type, in which the interspinous and intertuberous diameters are both narrowed. The lateral walls of the pelvis in this case converge rapidly from the inlet to the outlet, decreasing both the intertuberous and interspinous diameters. In this case, the persistence of a posterior position necessitated medium forceps delivery, in spite of the fact that the child was under average in size and the posterior sagittal diameter of Klien was long.

It is thus evident that no prognosis of the difficulty likely to be encountered at the outlet can be made without precise knowledge of the character of the pelvis as a whole, for on this depends the way in which the head is going to reach the outlet.

2. THE TRUE CONJUGATE DIAMETER; ITS PERPENDICULAR LINE AND RELATION TO PELVIC PLANES

Obstetric pelvimetry makes use of the sacral promontory as the posterior origin of the obstetric conjugate diameter of the inlet, while its anterior origin is defined as a point in the upper posterior curved edge of the symphysis. From the experience gained by a careful study of large numbers of skeletal pelves in museums, and from this large series of complete roentgenologic examinations on living women, we believe that the promontory is too unstable in position in relation to the plane of the inlet to be used as a point of origin of such an important obstetric diameter. This posterior point should be in the midline of the lower anterior surface of the first sacral vertebra where the continuation of the iliopectineal lines on either side meet each other, Fig. 20. When a line is drawn from this intersection to the point at the symphysis described above, the "available obstetric or true conjugate diameter" is not only defined in a manner standard for all pelves, but it also denotes the level of the first obstetric plane of the pelvis.

A perpendicular through the midpoint of this true conjugate diameter and first plane of the pelvis invariably points downward

through the center of the pelvis. In a few pelves, this perpendicular line may coincide with the central pelvic axis, but only when the plane of the symphysis and plane of the anterior upper sacral surface display a right-angled relationship to the true conjugate diameter. As a rule, the planes of the symphysis and sacrum slope posteriorly, and under these circumstances the perpendicular line by no means indicates the static axis of the pelvis. Its main purpose is merely to indicate the mean direction of descent through the true pelvis and to afford a means of determining the angular relationship of the head to the pelvic cavity, by defining clearly the direction in which it points for any level in the pelvis (Fig. 20, small arrows). It is the relationship of this line to the long axis of the head which indicates

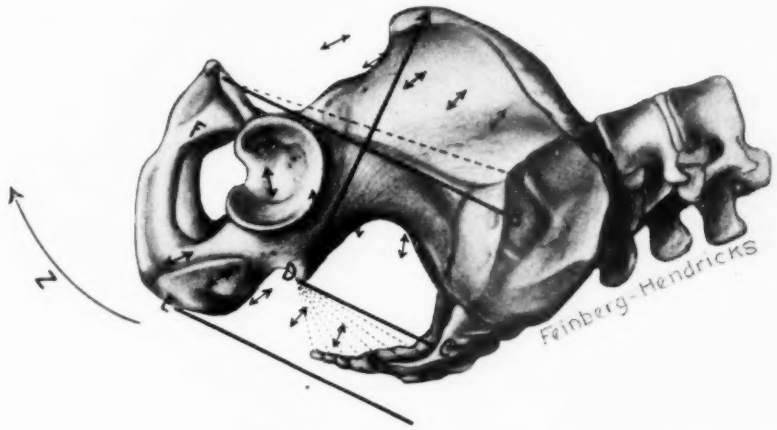

Fig. 20.—Parallel planes (after Dodge[4]) and perpendicular line at inlet. *A. B.*, Available obstetrical or true conjugate diameter and first parallel plane. *A. B*[1], Anatomical conjugate diameter from sacral promontory. *D. C.*, Second parallel plane. *E.*, Third parallel plane. *Z.*, Axis of extension. Note varying angular relation of fetal axis (small arrows) for three important levels of the pelvis in relation to the perpendicular through midpoint of *A. B.* (The perpendicular indicates the mean axis of descent.)

the presence or absence of synclitism (review Figs. 1 to 7). Any perpendicular line to the true conjugate would serve the same purpose, but the midpoint is most easily located.

From a practical standpoint, it is important to be able to follow and demonstrate the curve of descent of the head through the upper pelvis to the bottom of the posterior pelvis. The spines and interspinous diameter become reliable landmarks from which the spacial relationship of the head can be determined at all levels. The median sagittal suture of the fetal head for O T positions, or a point on it near the posterior fontanel, may be chosen as fixed regions of the head to compare with the static pelvis. It is realized, of course, that during vaginal examination in the individual case these points may

be obscured from molding, in which event other points on the head may be recognized and used for the same purpose. If the head has descended to the level of the spines and the median longitudinal suture is situated slightly in front of the interspinous diameter, it can be assumed that at that particular level the head is fitting squarely in the pelvic cavity. This assumption follows because the ischial spines are usually situated behind the center of the inlet. As described above, the anterior sagittal diameter, at this or any level, is always longer than the same posterior diameter. It extends to a point perpendicularly below the point of intersection of the transverse and anteroposterior diameter at the inlet. Whereas, if the sagittal suture points into the center of the fore pelvis considerably in front of the spines, Fig. 35, or backward at or slightly behind the ischial spines, Fig. 6, a lateral roentgenogram will reveal a head asynclitic to the perpendicular to the inlet.

The second plane of importance extends parallel with the first, from the level of the ischial spines to cut the lower segments of the sacrum at the point where the fourth and fifth segments normally slope forward to form the forward curvature of the lower birth canal *C. D.*, Fig. 20. This lower gutter is created by the fanlike sacrospinous ligaments on either side, spreading from the ischial spines to their insertion along the lower lateral border of the sacrum and the lateral aspects of the coccygeal vertebra, Fig. 20. This second plane is similar to the third parallel plane of Hodge[4] and has been chosen because arrest commonly occurs at this level.

The sacral tip and coccyx form the bottom of this trough which, in the main, may be considered a platform within the posterior pelvis, which is anatomically at a slightly higher level than the third or last parallel plane through the lowest extremity of the ischial tuberosities, Fig. 20, *E*. Normally, the pelvic surface of the coccyx and sacral tip is placed midway between the second and third parallel plane, and extends forward almost to the midpoint of the interspinous diameter. The point of origin of these pelvic planes is constant for all pelves, but the distance in levels with respect to each other, as well as the anteroposterior or transverse diameters of each plane, changes in accordance with depth and shape of the individual pelvis.

3. THE PELVIC SOFT PARTS

Having observed that the fetal head descends in a curved direction from the region of the symphysis toward the bottom of the true pelvis, we became interested in the possibility of an explanation in the pelvic soft parts rather than in the bony pelvis. This curve of descent is especially noticeable in normal efficient labor. Unquestionably, the forward excursion of the uterus with a contraction carrying with it the entire fetal axis is very important in directing the head

backward, since, during a contraction, the fetal head and body become a straight line, and the axis of drive downward is in the general axis of the fetal piston. Between contractions the long axis of the fetal head, and its changing asynclitic or angular relationship to the pelvis during this downward and backward curve of descent, can be assumed also to represent the relative direction of the forward excursion of the fetal axis when a contraction occurs. It is easy to demonstrate "posterior lateral flexion" by roentgenologic methods because, as the uterus relaxes, the fetal body sags against the mother's vertebral column, while the head is relatively fixed by the soft parts of the lower pole of the uterus. However, the lower pole of the uterus and adjacent soft parts likewise must exert an important influence in directing and maintaining the descent of the head downward and backward into the more ample posterior pelvis, at the same time promoting flexion of the head. Flexion, of course, is chiefly caused by the uniform resistance offered to the head by the normal tonicity of the lower uterine segment and cervix, as these structures dilate and retract. It must be realized that the anterior lower pole of the uterus is reinforced by strong fascial support anteriorly, the urinary bladder, and finally the unyielding bony symphysis and upper portions of the pubic rami. While we may suggest that the lower pole of the uterus assists in directing the fetal head downward and backward, we infer, of course, that it is augmented by the bony and fascial structures surrounding it, but especially those in front. Collectively, these factors afford sufficient resistance to the head, as it descends by the force of the straight uterine drive along the fetal piston, to deviate it slowly backward with contractions. The lower pole of the uterus, even alone, plays no small rôle in this directing mechanism. So far as we have been able to determine, the axis of the lower pole of the uterus is directed more in the axis of the posterior pelvis than in the fore pelvis, indicating the remarkable precision of anatomic structure, in that soft parts and hard parts appear to be so arranged as to gain the maximum in physiological effort. In the accompanying diagram, Fig. 21, the direction of the axis of the lower uterine segment and cervix will be found to point toward the lower posterior pelvis, avoiding the lower fore pelvis. It will also be observed that the fetal head, descending in line with the axis of the uterus, will be deviated backward by the resistance afforded by the structures anteriorly at *A*, Fig. 21.

If the soft parts in the upper pelvis represent at least one of the factors which allow the head to descend to the bottom of the posterior pelvis to a region confined by the two ischial spines and the lower sacral region and coccyx in the midline, the muscular struc-

tures of the perineum and pelvic diaphragm under the subpubic arch can be expected to influence the descent of the head through the lower fore pelvis and vulva. In Fig. 22 an attempt has been made to illustrate several important points regarding the relationship of the muscular attachments at the outlet. The pelvis has been sectioned laterally, just medial to the ischial tuberosities. Note first that the true pelvis approaches the form of a parallelogram, and that the bony depth anteriorly and posteriorly is almost equal. The levator diaphragm is practically parallel with the inlet, while the muscles supporting the vulva within the confines of the subpubic arch are, for practical purposes, at right angles to the levator sling (compare *A* with *B* and *C*, Fig. 22).

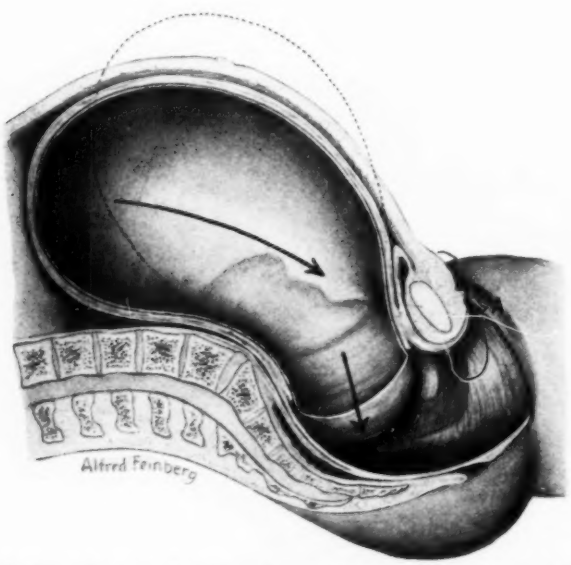

Fig. 21.—Relation of axes of soft parts of uterus and its lower pole to the static pelvis at the inlet. The axis of the uterus proper is downward and forward against the fascial and bony structures in front of the lower pole at "*A*." The axis of the lower pole (lower uterine segment and cervix) agrees with the axis of the posterior pelvis. We believe this soft part axis aids in permitting the head to descend and utilize the more available posterior pelvis.

An explanation of the significance of this anatomical arrangement in labor is assisted by reference to Hart's pubic and sacral segments of the pelvic outlet. During labor, as the head descends into the posterior pelvis, retraction and dilatation of the cervix occur, elevating the anterior vaginal wall, bladder, and other soft structures in the fore pelvis. At the same time, the soft structures of the pelvic outlet behind and below the posterior vaginal walls are dilated slowly, first in the posterior aspects of the pelvis adjacent to the lower part of the sacrum and coccyx, and the sacrospinous ligaments laterally. The head soon meets the resistance of this bony-ligamentous barrier (Fig. 22, *C*), cannot descend lower, and so moves forward and down-

ward by a series of up-and-down movements during contractions. As soon as the head passes in front of the coccygeal tip, only the soft parts of the levator sling and perineum are encountered (*B*, Fig. 22), and with each contraction the fetal head descends to bulge this region in the lower fore pelvis. When the perineum is distended to the maximum, the muscles of the subpubic arch and vulva, placed at a slightly higher level and at right angles, make it necessary that the head extend upward to pass under the arch in the terminal aspect of the delivery. In Fig. 22, note that the transverse muscles of the pelvic diaphragm, originating near the ischial tuberosity (junction of *A* and *B*), would normally be dilated and stretched by the head descending through the intertuberous diameter. If, however, the head were not directed at the proper angle against these strong mus-

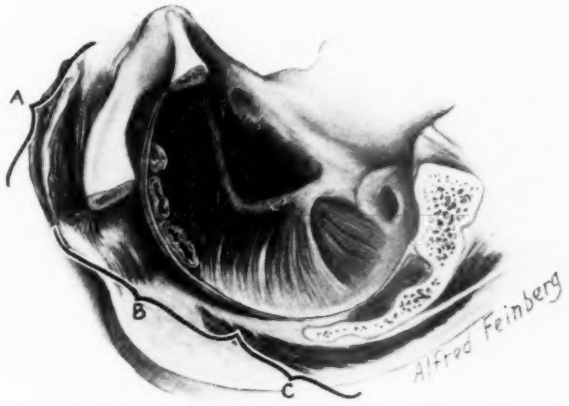

Fig. 22.—Soft parts of pelvic outlet. Note that the true pelvic cavity approaches the form of a parallelogram. The levator sling is almost parallel with the inlet. *A.* represents the vulva and pelvic diaphragm and other structures in the subpubic arch. *B.* represents the dilatable obstetric perineum. *C.* represents the lower curved sacral region which is resistant to descent below this level. Note the right-angled relationship of *"A."* to *"B."* and *"C."* with the strong transverse muscles of the pelvic diaphragm at junction of *"A."* and *"B.,"* and at a slightly higher level than *"B."*

cles, extension might occur too soon. The common occurrence of this feature explains why episiotomy is done frequently at the outlet.

The conception of a soft part axis, as distinct from the static axis of the bony pelvis, is not new. Fabbri, Sabatier, Pinard,[5] Parvin[6] and others called it the "dynamic axis" of the pelvis, but did not stress the importance of the lower pole of the uterus.

4. PELVIC AXES

The pelvic axis, for the most part, has been determined on the assumption that the depth of the fore pelvis is represented by the width of the symphysis, and that of the posterior pelvis by the long anterior surface of the sacrum. When it is realized that the true pelvis approaches the form of a parallelogram, as we have already

described, the "curve of Carus" can by no means represent the axis of the static pelvis. Hodge[4] and others realized that the upper portion of the axis at least was represented by a straight line to the region of the ischial spines, and concluded that the perpendicular axis of the inlet represents this straight axis of descent followed by the fetal head.

On the basis of this investigation, a diagram to illustrate the axis of descent of the fetal head would be arranged as in Fig. 23. The axis of the line of descent, illustrated diagrammatically in Fig. 23, is formed by joining similar points on the series of fetal heads. The shape of this curve varies in relation to the pelvis in each individual case, but the average curve simulates the axis illustrated. This dia-

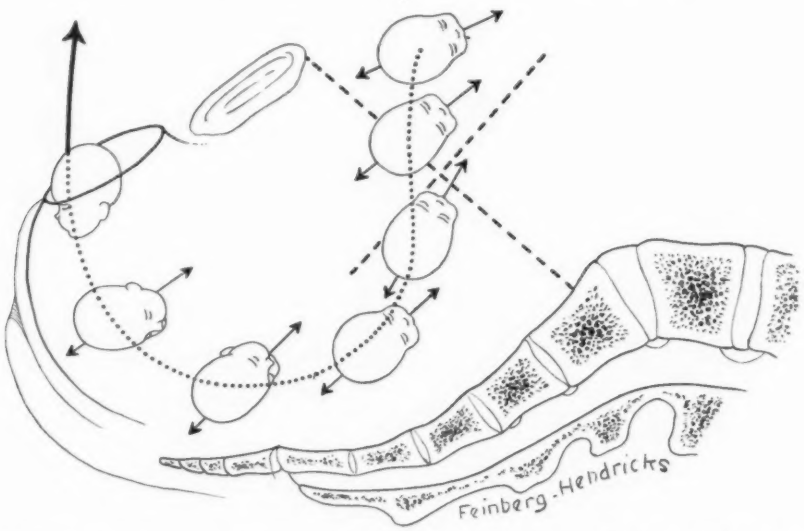

Fig. 23.—Diagrammatic representation of the axis of descent as revealed by this investigation. A line joining similar points on the series of fetal heads reveals general character of the curved axis. Note the angular relationship between the fetal axis and the perpendicular axis of the pelvis, and the difficulty of anatomically associating the relation of head to pelvis at any given level. The fetal piston moves upward and downward in a straight line with each contraction. Note relationship of its position to the static pelvis at the following levels: (1) During engagement from a posterior parietal position at the inlet. (2) At low level in posterior pelvis (see Fig. 24, *C. D.*). (3) Shift forward with descent along inclined plane of outlet. (4) On perineum to distend it by straight drives downward in axis of fore pelvis (see Fig. 24, *G. F.*).

gram will show the great difficulty of associating varying angular relationship of the long axis of the head to any axis of the static pelvis, from the fact that the head follows an axis which, for any given position, bears no constant anatomic relationship to the pelvis until the head is fixed under the pubic arch in the axis of the soft parts of the pelvic outlet.

There are, however, two levels in the pelvis for which a static axis may be described and through which the head passes in normal labor or must be made to pass if, in case of arrest, forceps delivery becomes

necessary. These two axes are illustrated in Fig. 24. The first of these is the axis of the posterior pelvis which originates at *C*, the point of intersection of the widest transverse diameter with the true conjugate diameter at the inlet, and descends parallel to the sacrum. The head may utilize this axis from the beginning of labor in some cases, but, as a rule, when there is a posterior parietal position at the inlet, with the long axis of the head and fetus directed downward and forward in the fore pelvis, it must first swing downward and backward. Under these circumstances, the axis of the posterior pelvis, as described, is not used by the head in the upper pelvis, but only for a short and variable distance in the posterior lower pelvis near the sacrum. From a practical standpoint, it is at this level that arrest of the head is prone to occur, and hence the axis of the posterior pelvis, as described (*C. D.*, Fig. 24), must be appreciated when traction by forceps is used.

After rotation has occurred in the inclined plane of the outlet, a common position for arrest to occur is between the second (ischial spines) and third parallel planes (ischial tuberosities) in the fore pelvis, with the head close to or on the pelvic floor. In normal labor, the head also descends through this axis. The axis of the fore pelvis may be defined as a line originating at the center of the anterior sagittal diameter of the inlet at *E*, Fig. 24, and descending parallel to the posterior surface of the symphysis, *E. F.* Here again, only the lower part of the axis is normally used by the head, usually the short distance between *G. F.*, Fig. 24.

When a head is arrested in the upper midpelvis and forceps are indicated, the line of traction should avoid the axis of the fore pelvis, just described, and follow the physiologic curve of descent (the upper curved axis of descent as in Fig. 23) downward and backward toward the sacrum, ultimately using the axis of the posterior pelvis (*C. D.*, Fig. 24).

Two conceptions of the axis of the pelvis, as described by other workers, are illustrated in Fig. 25 *A* and *B*. The first obvious difference between these conceptions and those revealed by this investigation refers to the point of origin of the axis at the inlet; whether it should originate at the center of the superior strait, or at a more posterior point representing the intersection of the widest transverse and anteroposterior diameters (*C*, Fig. 24). In all pelvic types, the posterior segment of the inlet is always wider than the anterior segment, and the head normally makes use of this anatomic fact. Moreover, the lower pole of the uterus and its adjacent structures assist in deviating the head backward in this direction. Hence the pelvic axis should originate at the point we have described. Since the fore pelvis is too far removed at this high level to influence the direction of the axis

from this point, the inclination of the sacrum rather than its curvature must represent the anatomic factor most significant in the determination of this direction. As we have noted, a line parallel to the sacrum can be defined easily anatomically as the axis of the posterior pelvis (*C. D.*, Fig. 24).

Except for its central point of origin at the inlet, the upper part of the "curve of Carus," in direction at least, is comparable to the

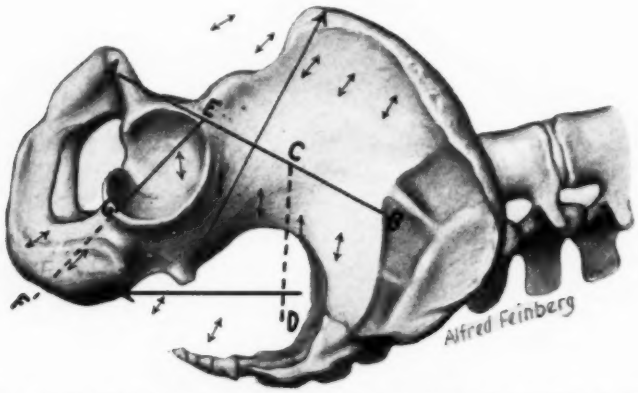

Fig. 24.—Anatomical axes of true pelvis. *C.*, Point of intersection of widest transverse and anteroposterior diameters of inlet. *A. C.*, Anterior sagittal diameter. *C. B.*, Posterior sagittal diameter. *C. D.*, Axis of posterior pelvis originating at "*C*" and descending parallel with upper segments of the sacrum. Head utilizes lower aspects of this axis after engagement from the posterior parietal position. *E. F.*, Axis of fore pelvis originating at "*E*," the midpoint of the anterior sagittal. The head utilizes lower portion of the axis *G. F.* after it has moved forward in direction of heavy arrow. The perpendicular line indicates the "mean" direction of descent, but the head usually bears an angular relation to it for different levels (small arrows).

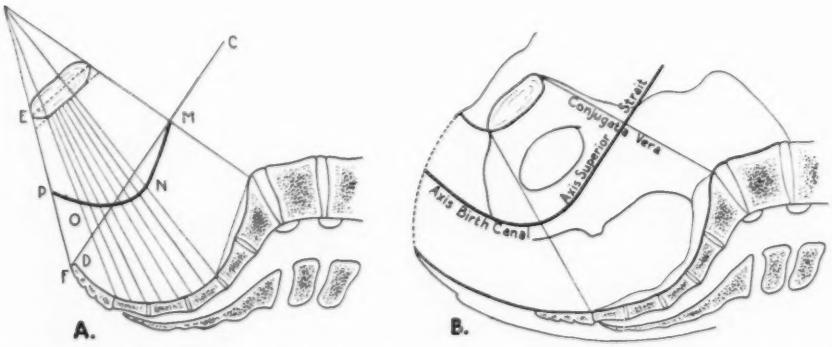

Fig. 25.—Two theories of the static pelvic axis. (A) "Curve of Carus" (redrawn from Bedford[9] 1861) representing the midpoint of planes from symphysis; *C. D.*, Axis of superior strait. *E. F.*, Plane of inferior strait. *M. N. P.*, Central curved line. Earlier obstetricians assumed that the width of the symphysis formed the anterior boundary of the true pelvis rather than the entire depth of the fore pelvis. (B) Straight axis perpendicular to inlet to level of spines. (Redrawn from Williams[10] 1930.) This theory does not regard the relationship to the inclination of the sacrum. Other authorities have pointed out this fact, but failed to define the axis clearly from the anatomical standpoint.

axis of the posterior pelvis as described (compare Fig. 25, *A* with *C. D.* of Fig. 24). A perpendicular from the inlet, however, does not consider the inclination of the sacrum, and therefore cannot repre-

sent the axis of the pelvis, except in certain pelves possessing a sacral inclination parallel to this perpendicular. This parallel relation, for instance, does not obtain in the diagram illustrated in Fig. 25, *B*.

We have already referred to the variable direction this perpendicular will assume, even when the plane of the inlet is made to correspond with a standard "available obstetrical or true conjugate diameter." The variable position of the promontory will further modify the relationship of any perpendicular axis to the true pelvis whenever the promontory is used as a point of origin of a diameter from which the perpendicular is drawn. These significant factors may be seen to advantage in Fig. 25, *A* and *B*.

Traction with forceps may be safely applied in the central axes of normal pelves (as in Fig. 25) and very flat forms, because in certain examples of the latter type the widest transverse diameter may bisect the anteroposterior diameter of the inlet. The importance of utilizing the axis of the posterior pelvis (Fig. 24, *C. D.*) becomes apparent if the fore pelvis is narrow, in which event traction along this axis allows the head to descend to a low level in the posterior pelvis by avoiding the abnormality present in the fore pelvis. If, in such a case, traction is made in the central axis of the pelvis, the head is angulated away from its physiologic axis in the posterior pelvis and directed into the narrow fore pelvis at a higher level, thereby greatly increasing the difficulty.

Milne Murray,[7] Hirst[8] and others have agreed that the axis of the pelvis is determined by the inclination and curvature of the sacrum, but this relationship has always been associated with the perpendicular of the superior strait or the center of line radiating from the symphysis, as in Fig. 25, *A*. As we have noted above, no stable relationship can be defined from such a premise, even though the relationship of the pelvic axis to the sacrum is correct.

The lower part of the "curve of Carus," Fig. 25, *A*, or a similar forward curve in the lower part of the axis in Fig. 25, *B*, does not represent the axis followed by the head at this low level, because, as it moves forward from the bottom of the posterior pelvis, the head is still confined by the pelvic parallelogram and must descend straight downward in the axis of the fore pelvis, as designated in Fig. 24, *E. F.* The head can make use of such a forward curvature only after descent has occurred to bulge the perineum to the maximum. As the act of extension begins, the head is fixed in the dilated birth canal under the pubic arch. Only under these circumstances does the occiput swing upward in a curved direction, somewhat comparable to the lower curved part of the axis illustrated in Fig. 25, *A* and *B*.

5. THE NORMAL MECHANISM OF LABOR

Many factors concerned in the normal mechanism of labor have already been described. It remains to apply the principles outlined above. In a series of semidiagrammatic illustrations we have attempted to reveal the relationship of the head to the pelvis, at the inlet, at the bottom of the posterior pelvis, in the lower fore pelvis, and finally the mechanism at the oulet, so far as we have been able to visualize the process. A gynecoid or normal female pelvis has been used in these illustrations, Figs. 26 to 37.

When the pelvis is normal and the child is average in size, it is doubtful if the bony pelvis plays a very significant rôle in the mechanism of labor. Yet, under these circumstances, as well as with abnormal pelves, we have consistently observed that the general axis of descent just outlined is followed. With the soft parts of the birth canal directing the fetus at each level along the optimum anatomical axis of the pelvis and through the most ample diameters, the perfection of natural labor is attained.

In Figs. 26, 27, and 28 the axis of the fetus will be recognized as conforming to the posterior parietal tendency at the inlet for the anterior, transverse, and posterior positions. The uterine thrust with each contraction directs the fetal head downward and forward toward the fore pelvis. As labor progresses, the fetal and uterine axes move forward more perpendicular to the inlet. With each contraction, however, the fetus moves forward and downward in a straight line, so that the anterior portion of the lower pole of the uterus, reinforced in front by strong fascial supports, bladder, and more remotely the bony symphysis, receives the impact of the fetal head. Thus, coincident with descent, the median suture (demonstrated to best advantage in the O T position) slowly moves away from the region of the symphysis toward the mid- and posterior pelvis, constituting a movement which may be termed "posterior lateral flexion." Precisely the same movement or rotation around the central point of the fetal head takes place in anterior and posterior positions. By this movement an original posterior parietal position squares itself into the inlet by fixation of the head against the promontory or upper sacral region posteriorly, as the anterior parietal descends behind the symphysis. Thus, at a certain level in the upper midpelvis, as the head is brought more and more under the influence of the normal tenseness of the lower uterine segment and cervix, the long axis of the head is gradually deviated downward and backward toward the bottom of the posterior pelvis, Figs. 29, 30, and 31. As the head descends lower into the true pelvis, the anterior parietal bone in transverse presentations becomes more easily palpable. It would seem that this observation led Nägele and others to stress the frequency

of this position and to assume that at the inlet this position was the rule. It will be noted, however, that, while the position may be primary in the rare type of case in which the axis of the fetus at the onset of labor is anterior to any perpendicular line from the inlet (as in Figs. 2 and 4), for the most part, this lower anterior parietal position represents a phase in the movement of posterior lateral flexion from an original posterior parietal position at the inlet. Thus, under the guidance of the lower uterine segment and more remotely the shape of the fore pelvis at the inlet, the fetal head, originally pointing

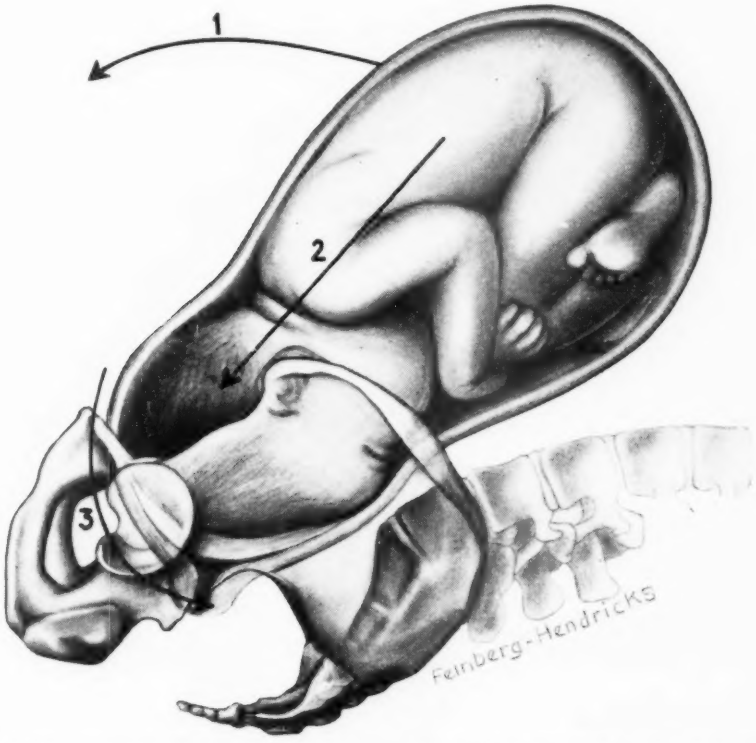

Fig. 26.—Normal mechanism of labor. Engagement from the posterior parietal position (anterior position). (1) Uterus and fetal axis moves forward. (2) Straight drive of uterus along fetus forward and downward. (3) Deviation of head downward and backward from influence of lower pole of uterus, assisted by fascial and bony support anteriorly.

downward into the fore pelvis, by continual straight thrusts of the uterine contraction, is slowly carried backward toward the posterior lower pelvis and close to the sacrum (Figs. 29, 30, and 31) in the axis of the posterior pelvis, Fig. 24.

It will be noticed in these illustrations that at this stage the head avoids the fore pelvis and continues to do so until it meets the resistance offered by the platform of the ischial spines and the lower sacrum and coccyx. This obtains even in cases in which the fore

pelvis is narrowed. It will also be observed in Figs. 29, 30, and 31 that the long axis of the head at this low level tends to be posterior to the perpendicular axis of the inlet. Usually at this level the cervix has attained almost complete dilatation, and since the head cannot descend farther in this downward and backward direction, owing to the resistance of the posterior bony pelvis, it begins rotation from the transverse or posterior positions into the muscular gutter of the pelvic floor.

The head is forced against this inclined pelvic floor by a series of straight thrusts which carries it downward and forward into the fore

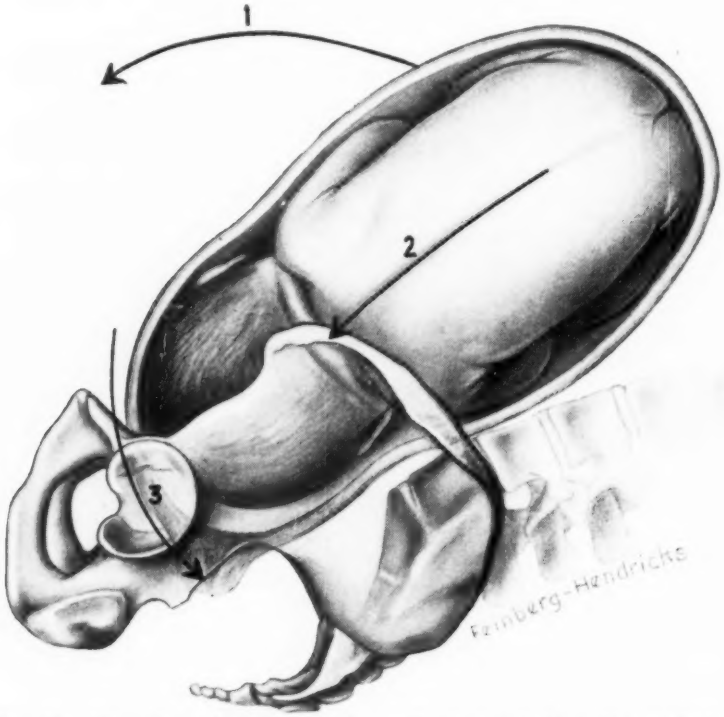

Fig. 27.—Normal mechanism of labor. Engagement from the posterior parietal position (transverse position). (1) Uterus and fetal axis moves forward. (2) Straight drive of uterus along fetus forward and downward. (3) Deviation of head downward and backward from influence of lower pole of uterus, assisted by fascial and bony support anteriorly.

pelvis. From this point it descends more directly against the dilatable perineum in the axis of the fore pelvis, *F. G.*, Fig. 24. Normally, so far as we have been able to observe, extension does not begin at this level, Figs. 32 and 33. In fact, quite the contrary occurs, namely, flexion, as the anterior fontanel and region of the forehead comes in contact with the lower sacral tip and coccyx and the sacrospinous ligaments posteriorly. The pelvic floor acts as an inclined plane, bringing the head close to and parallel with the plane of the posterior surface of the symphysis so that the finger cannot be passed upward

between the head and the bone in this region, while formerly, when the head was in the lower posterior pelvis, considerable space existed in this region. Even when the caput is bulging the perineum at the height of a contraction, the head may recede upward to the low mid-pelvis between contractions, but the entire fetal axis has changed from its former position (compare Figs. 29, 30, and 31 with Fig. 32).

Occasionally, as the head descends in the fore pelvis, the lower portion of the uterus, adapted to maintain the head close to the sacrum, as in Figs. 29, 30, and 31, will cause extension of the head between

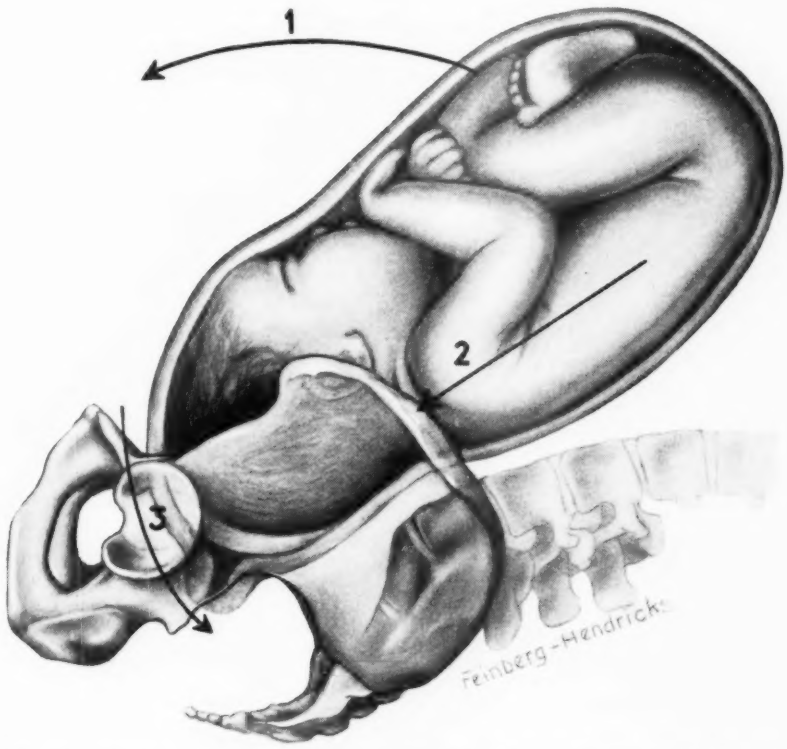

Fig. 28.—Normal mechanism of labor. Engagement from the posterior parietal position (occipitoposterior position). (1) Uterus and fetal axis moves forward. (2) Straight drive of uterus along fetus forward and downward. (3) Deviation of head downward and backward from influence of lower pole of uterus, assisted by fascial and bony support anteriorly.

contractions, as illustrated in Fig. 34. But, with the onset of a contraction, this restraint on the part of the dilated cervix is not sufficient to prevent the back from becoming straight, as in Figs. 32 and 33.

If a transverse position has been maintained to the bottom of the posterior pelvis, on account of the presence of an android posterior pelvis at the inlet, it will be found that the sagittal suture slowly moves forward with descent to correspond eventually with the center

of the fore pelvis. This movement, in which the axis of the fetal head assumes the axis of the lower fore pelvis (*G. E.*, Fig. 24), may be termed "anterior lateral flexion," Fig. 35. This is the movement imparted to the head by the cephalic application of forceps, even before any traction is attempted, as the posterior blade of the forceps cannot avoid angulating the long axis of the head away from the low posterior pelvis into the fore pelvis.

Posterior positions, which have descended to the level shown in Fig. 31, rotate spontaneously, passing through a phase of lateral flexion, descent, and spiral rotation to the anterior position.

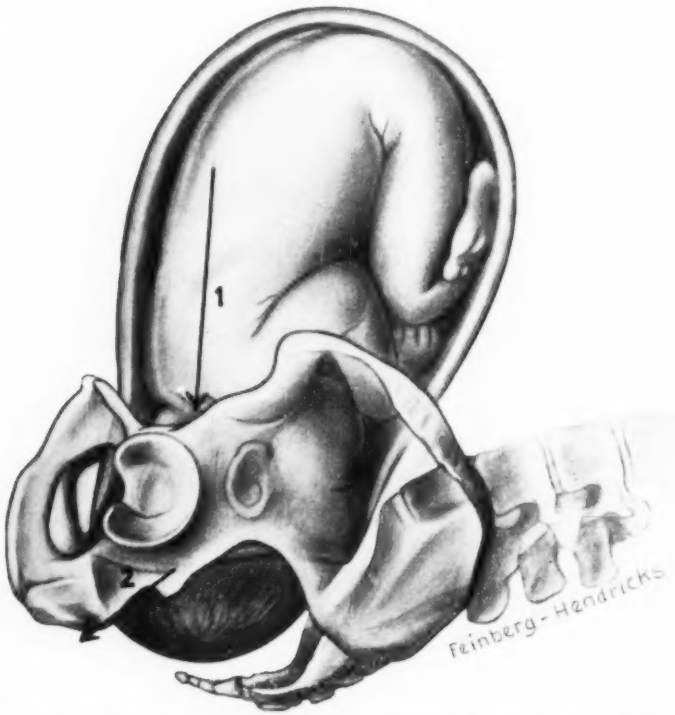

Fig. 29.—Normal mechanism of labor. Anterior position: descent to bottom of posterior pelvis to a region confined by forward sacral tip and coccyx in midline and the ischial spines laterally (the three-point landing). The head tends to be posterior to the perpendicular line from the inlet and avoids the lower fore pelvis.

Finally, the head descends to the lowest level of the fore pelvis until obstructed by the muscular pelvic floor alone, the flexed head angulated so that the chin occupies a high level in the posterior pelvis, with the anterior fontanel opposite the sacral tip. The long axis of the fetus is now oblique to the true pelvis, because the shoulders have moved forward close to the posterior aspect of the symphysis. The occiput at the height of a contraction passes at an angle downward, partially through the subpubic arch, before any act of extension begins. In fact, the head, as Hodge[4] and others have noted, descends

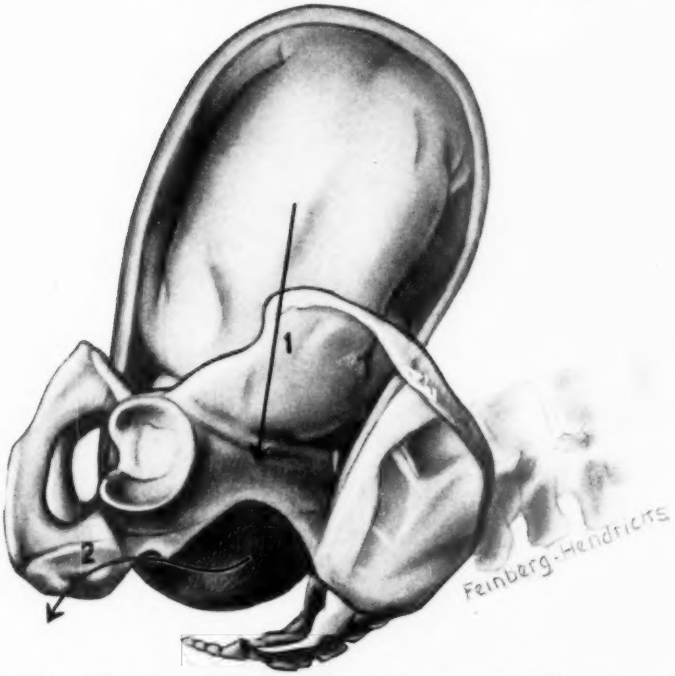

Fig. 30.—Normal mechanism of labor. Transverse position: descent to bottom of posterior pelvis to a region confined by forward sacral tip and coccyx in midline and the ischial spines laterally (the three-point landing). The head tends to be posterior to the perpendicular line from the inlet and avoids the lower fore pelvis.

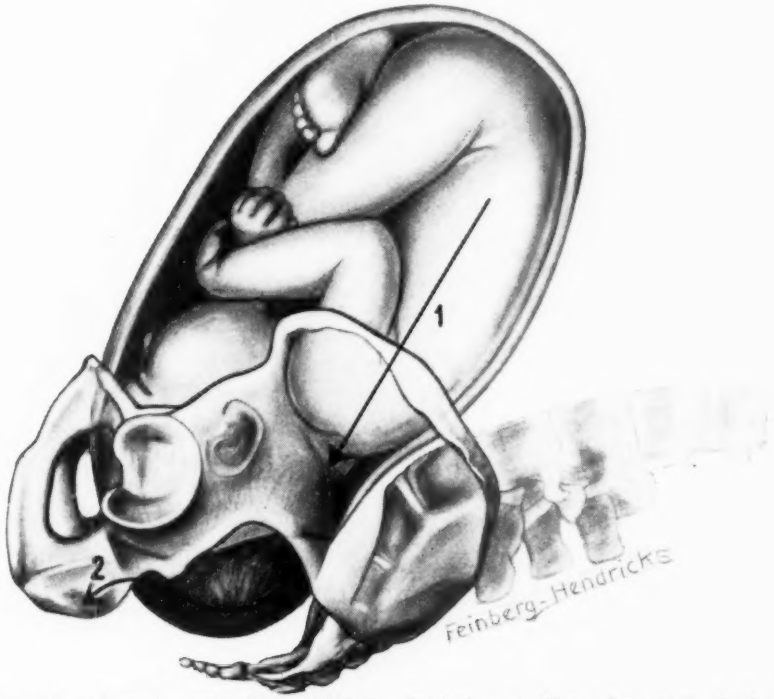

Fig. 31.—Normal mechanism of labor. Posterior position: descent to bottom of posterior pelvis to a region confined by forward sacral tip and coccyx in midline and the ischial spines laterally (the three-point landing). The head tends to be posterior to the perpendicular line from the inlet and avoids the lower fore pelvis.

until the biparietal diameter is opposite the intertuberous diameter of the pelvis before the act of extension begins, Fig. 33. The base of the occiput and the neck of the child are on a level with the under surface of the symphysis. This low descent of the head before extension occurs is not generally appreciated, nor is the fact that coincident with this, the occiput, descending in the axis of the fore pelvis, has partially passed through the subpubic arch, Fig. 36.

Note the attitude of the fetus illustrated in Fig. 36. This attitude allows a maintenance of flexion and at the same time permits the caput to descend downward and forward partially through the subpubic arch. The greater the angle between the plane of the symphysis

Fig. 32.—Normal mechanism of labor. Rotation to anterior position. Back close to symphysis. With a contraction, fetus descends against perineum in axis of fore pelvis (see Fig. 24, *G. F.* of *E. F.*).

and the plane of the pubic rami, the more significant this angular passage of the occiput through the arch becomes, in view of the fact that the head is virtually free of the confines of the bony pelvis before the sudden act of extension begins. The act of extension primarily is caused by the strong transverse muscles between the lower aspects of the ischiopubic rami. As the head swings forward, free of the tuberosities of the ischium, the shape of the dilating gutter creates a curved axis which carries the occiput in front of the plane of the symphysis, while only the neck of the child is brought in contact directly below the symphysis with the subpubic ligament and the upper portions of the pubic rami, Fig. 37.

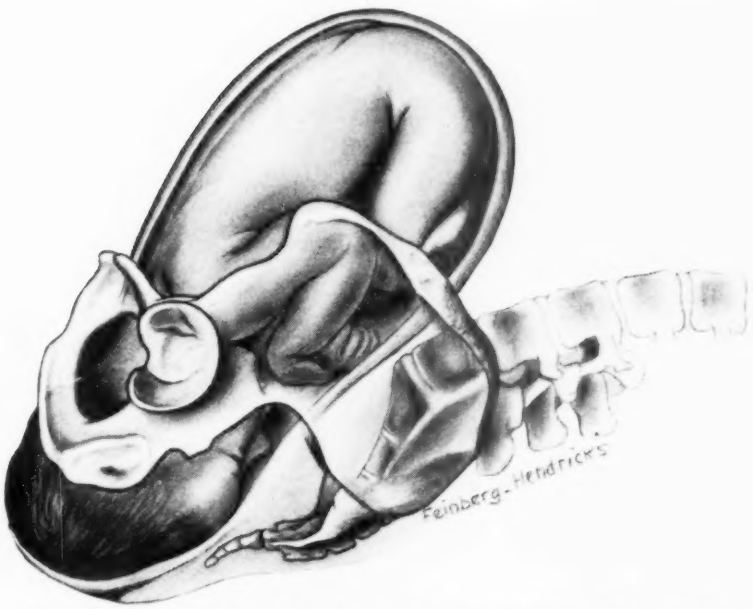

Fig. 33.—Normal mechanism of labor. Anterior position. Vertex descending to low level with biparietal diameter in the intertuberous diameter. Perineum bulging. Flexion maintained. Neck of fetus behind under-edge of symphysis.

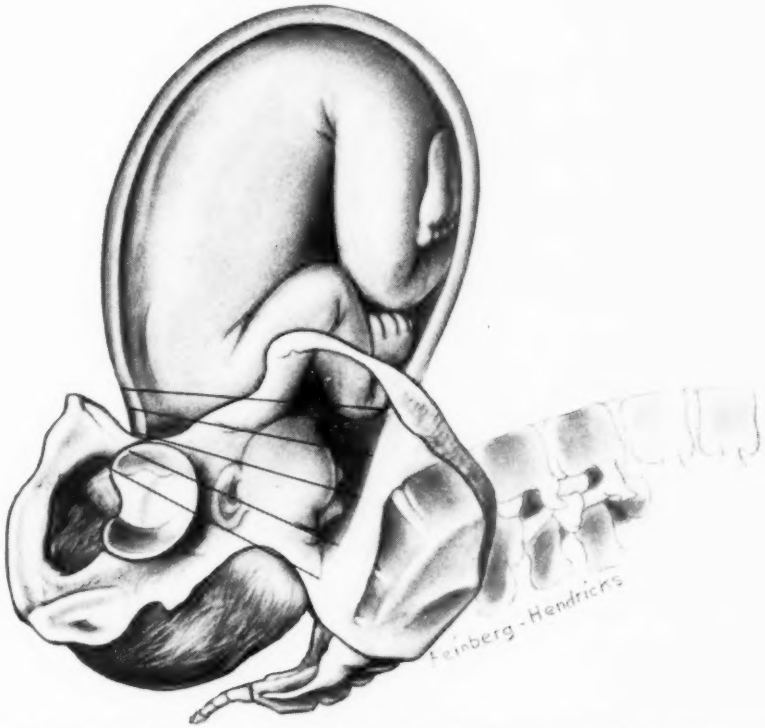

Fig. 34.—Between contractions the fetal attitude shown in Fig. 32 may reveal the attitude illustrated above, since the tense lower uterine soft parts attempt to hold the fetal body close to the posterior wall of the pelvis.

The manner by which the shoulders become adjusted to the shape of the pelvis is difficult to study. The stereoroentgenograms reveal the child at rest between contractions, and under these conditions it is unusual to observe any obvious twist at the neck, irrespective of the position of the head. After the vertex is born, the shoulders, descending into the pelvic cavity, rotate, and the head follows in the so-called act of restitution. Further work is necessary to clarify ideas on the factors concerned in restitution.

A clear understanding of this mechanism will explain why the handles of the forceps must not be elevated until the caput is well

Fig. 35.—Normal mechanism of labor. If rotation fails to occur at level shown in Fig. 30, a transverse position descending into fore pelvis must demonstrate "anterior lateral flexion." This movement occurs characteristically in android types.

showing. Traction must be made in the axis of the fore pelvis to cause the head to descend downward and forward, partially through the subpubic arch, before the act of extension is encouraged.

In the course of our study of this normal mechanism, we had occasion to study certain deviations from it which we will discuss briefly. We hope that in subsequent publication we will be able to point out other deviations of equal importance.

6A. MECHANISM IN THE ANDROID AND FLAT PELVES

In a recent report we have shown that in normal pelves engagement occurs in 70 per cent of the cases in the transverse position.[3] But most

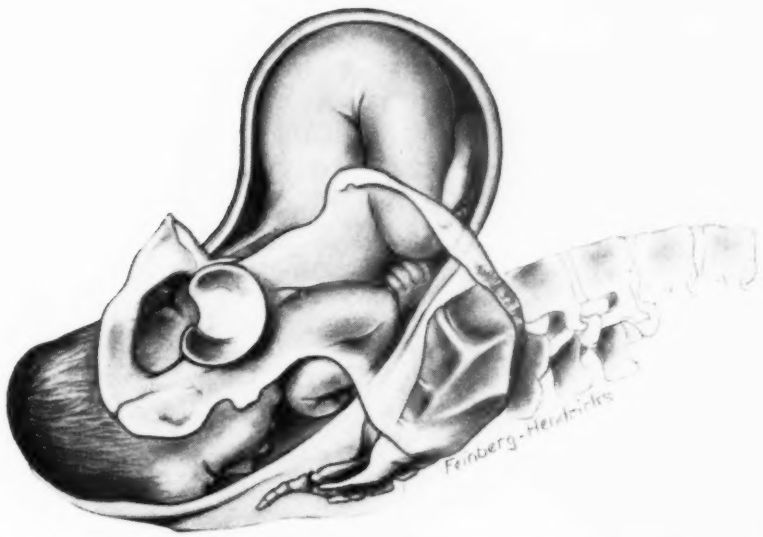

Fig. 36.—Flexion frequently is maintained even as the head begins to pass downward through the subpubic arch. This necessitates a peculiar attitude of the fetus with arching of the back, as illustrated.

Fig. 37.—As the head is grasped by Ritgen's manoeuvre, extension begins rapidly. The head, already partially through the subpubic arch, extends rapidly and is directed upward in axis of soft part canal in this region to clear the transverse muscles of the pelvic diaphragm. The lower occipital region and neck of the child utilize the upper aspects of arch under symphysis.

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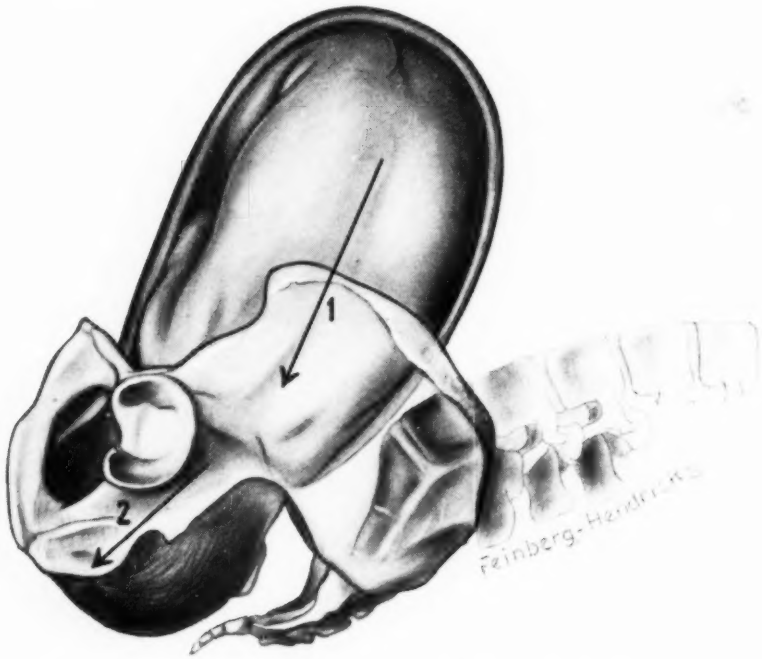

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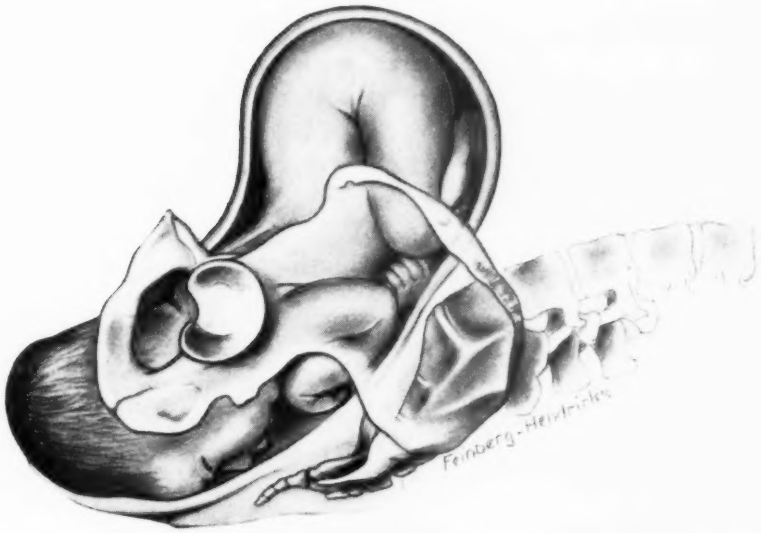

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obstetric authorities associate "deep transverse arrest of the head" with the posterior position, in that it is assumed to represent an incomplete stage in the process of anterior rotation. Our statistical evidence from the large series of case studies, which we have as yet made no attempt to tabulate, definitely associates this condition with the android pelvis, in which the mechanism is that of a transverse position from the inlet to the level of arrest. It is the exception rather than the rule to find a posterior position at higher levels in the pelvis in a case which becomes arrested in the transverse position lower in the pelvis. Occasionally, at higher levels in this type of case, the transversely placed median sagittal suture may be slightly anterior or posterior to the exact transverse plane, but not sufficiently obvious to warrant classing the position as other than a transverse.

The high incidence of characteristic android forms in the cesarean section and midforceps group of this series warrants considering the android pelvis as potentially the cause of more serious obstetric difficulty than any other single pelvic type. The problem is rendered more serious when it is realized that android pelves are prone to occur in rather characteristic physical types, which are poor subjects for labor. The child is usually above average weight and may display, in addition, definite evidence of postmaturity. We have consistently observed that, when a large head delivers normally through an abnormal pelvis, the mechanism of labor has been so directed by efficient uterine contractions and normal reacting soft parts as to allow the maximum in fetal pelvic adaptation for all levels of the pelvis, according to the principles discussed in normal labor. This indicates that difficulty in labor is not simply one of head size *versus* pelvic size, but that the behavior of the uterus and of the soft parts is a most important factor. This accounts for the observation made by us over and over again that, with the same size of head and the same type and degree of pelvic abnormality, one patient may deliver spontaneously while another requires a forceps delivery or even a cesarean section. Thus any facts concerning the peculiarities of the mechanism of labor in android types become especially important.

The narrow sacrosciatic notch, associated with the short, posterior iliac portion of the inlet over the apex of the notch, and with the sharp inward curvature of the posterior extremity of the iliopectineal lines, is characteristic of the typical android posterior pelvic segment. The shape of the lateral extremities of this flat posterior segment does not favor engagement of the occiput in the oblique position, unless the fore pelvis is sufficiently long and narrow to introduce an anthropoid tendency. In this latter event, engagement in the oblique posterior position will be favored.

Accordingly, in the more typical android types, engagement can occur only in the transverse position. A posterior parietal tendency usually is present at the inlet, but with reasonably efficient labor the anterior parietal bone descends more rapidly than the posterior, and the fetal head becomes directed into the posterior pelvis close to the sacrum.

Normally, in gynecoid or more ample pelvic types, spiral anterior rotation begins when the head has reached the bottom of the posterior pelvis.

In android forms, however, rotation is prevented at this level by the shape of the pelvis at the inlet, and hence the head must descend to a much lower level for rotation to occur. In Figs. 38 to 41, the anatomical explanation for the persistence of this occipitotransverse position, and for the mechanism which obtains in the lower pelvis, is illustrated. It will be observed that the temporal region of the partially flexed head meets with the resistance of the lateral aspects of the sacral alae at the inlet as soon as there is any attempt at rotation at or above the ischial spines (Fig. 38). This influence continues to act even when the head has descended to a low level in the posterior pelvis, Figs. 39 and 40. In Fig. 39 a lateral view shows the vertex close to the sacrum, with the median sagittal suture of the head in the region of the interspinous diameter. The resistance offered by the lower curved surface of the terminal sacrum and coccyx, along with the sacrospinous ligaments originating laterally from the ischial spines, prevents further descent in the axis of the posterior pelvis. Since rotation cannot occur, due to the reason suggested above, and descent must continue, the median sagittal suture moves forward and downward into the fore pelvis under the influence of straight drives along the fetal axis with each uterine contraction (Fig. 40). Between contractions the head demonstrates "anterior lateral flexion" in relation to the fetal body, so that this movement into the fore pelvis may be termed "anterior lateral flexion," Fig. 40. This movement occurs in normal labor synchronous with rotation and descent on the pelvic floor. But, in android pelves, sufficient descent must be gained to allow the brow to sweep under the promontory, and only when this act is mechanically possible can rotation take place, Fig. 41. It is possible, though rare in occurrence, for the head to be delivered in the O T position by a movement of extreme anterior lateral flexion.

The above description of the mechanism of labor may be considered normal for the android type and is that which occurs in physiologic labor in these cases. Naturally, if this premise is correct, it is important, when forceps are used for "deep transverse arrest of the head,"

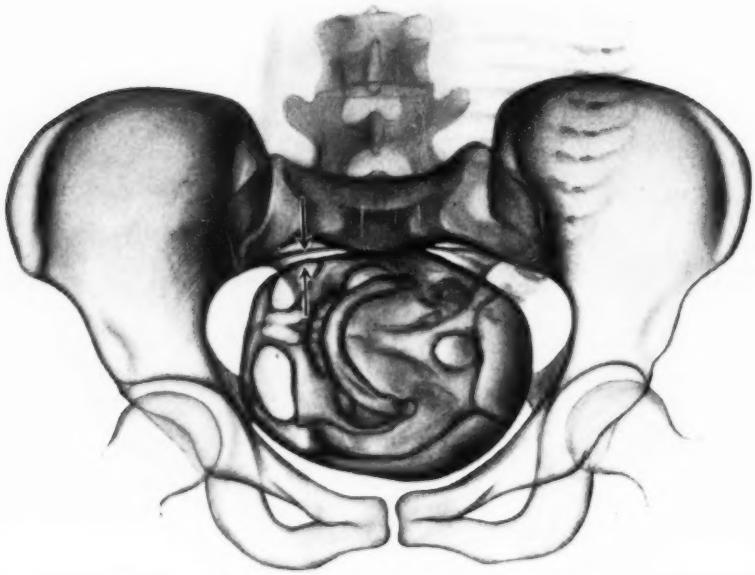

Fig. 38.—The normal mechanism in android types (occipitotransverse position maintained to a low level). Inlet view: rotation from the O T position to an oblique anterior position fails to occur in the low posterior pelvis on account of the opposing forces between the temporal region of the head and the lateral aspects of the sacral region at the inlet (see arrows).

Fig. 39.—Normal mechanism in android types. Lateral view of Fig. 38. Vertex in O T position at bottom of posterior pelvis close to lower sacral region.

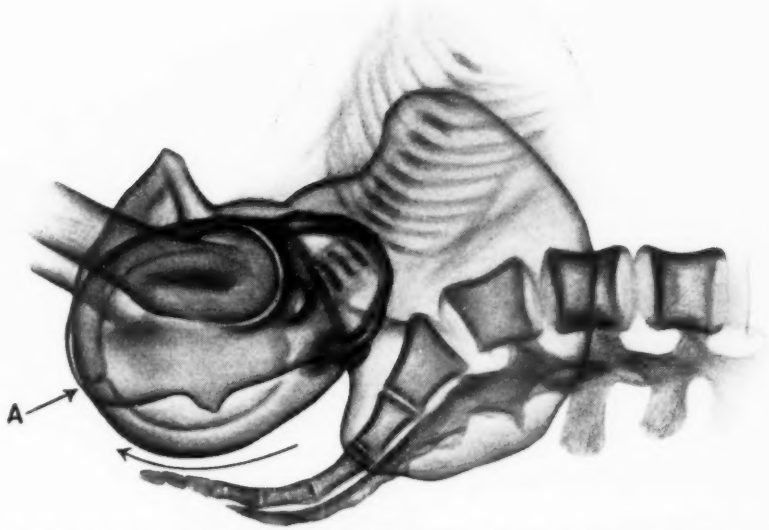

Fig. 40.—Normal mechanism in android types. Lateral view. If the side walls of the pelvis are straight and the interspinous diameters wide, the O T position persists (for reasons illustrated in Fig. 38). For descent to occur the head demonstrates "anterior lateral flexion" between contractions as it descends in the fore pelvis. This means that the median sagittal suture moves more and more in front of the ischial spines and downward.

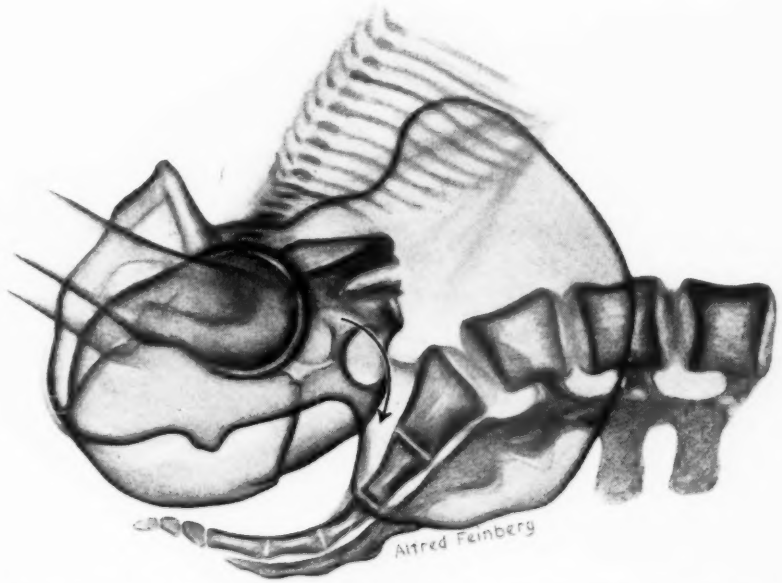

Fig. 41.—Normal mechanism in android types. Lateral view. Anterior spiral rotation from the O T position occurs at such a level in the lower fore pelvis that the fetal brow may move without resistance under the promontory.

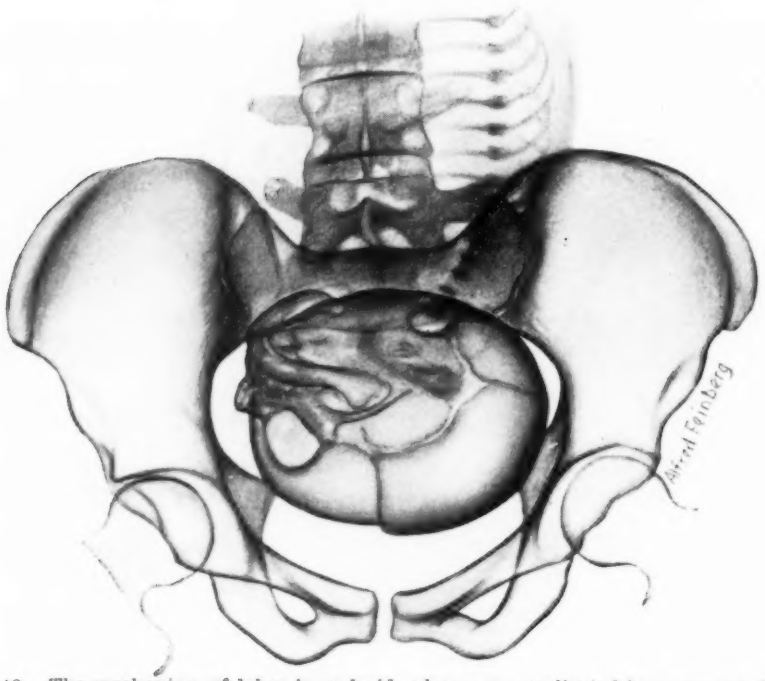

Fig. 42.—The mechanism of labor in android pelves, as complicated by a narrow interspinous diameter. Normal posterior parietal O T position engaging at inlet.

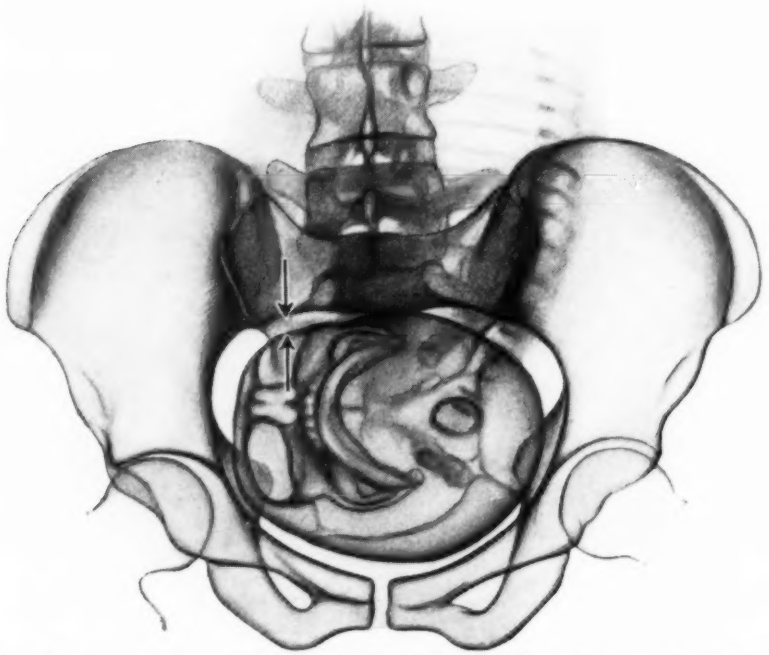

Fig. 43.—Same case as Fig. 42. Arrest at bottom of posterior pelvis in the O T position. Rotation to anterior oblique position is prevented by the flat android pelvis at the inlet (see arrows) and the narrow interspinous diameter below.

to maintain this O T position until the head has been brought to the proper level at which rotation can occur. We have a number of cases where this principle with forceps has not been applied, and too early attempt at rotation of a poorly flexed and unmolded head have resulted in stillbirth or serious soft part injury to mother and child.

If the O T position is maintained, descent can occur only if the side walls are straight and the intertuberous and interspinous diameters are wide. This point is important. The presence of a narrow interspinous diameter greatly complicates the problem of rotation and descent of the transverse position, as illustrated in Figs. 42 and 43.

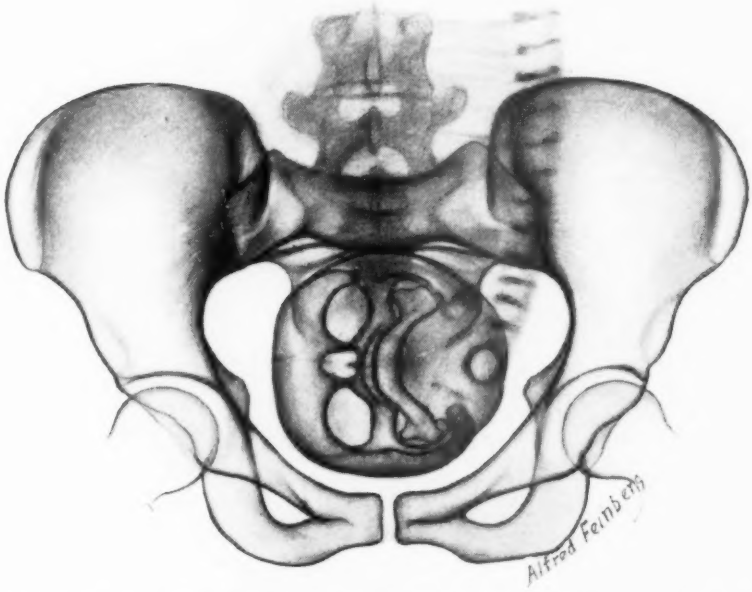

Fig. 44.—When a head is well flexed, rotation is usually accomplished by manual methods in any type of pelvis (android type illustrated).

In fact, this type of pelvis may offer one of the most difficult problems in obstetrics from the mechanical standpoint. Unless the obstetrician is cognizant of the narrow interspinous diameter and the android character of the posterior pelvis, and is aware of the fact that these two abnormalities are acting to prevent rotation and descent, traction by forceps is likely to be misdirected, and version and breech extraction may in the end be the safer method of delivery. In the case illustrated, Figs. 42 and 43, the poorly flexed head could not be rotated because the temporal region conflicted with the lateral alae of the sacrum at the inlet, while, below, the narrow interspinous diameter offered obstruction to the forward rotation of the occiput. In other words, the head could not descend below the posterior pelvis

in the O T position to utilize the fore pelvis. No great difficulty had occurred up to this point, the head having engaged in a posterior parietal position, as illustrated in Fig. 42. The cervix was almost fully dilated. The case was handled as follows: Barton forceps were easily applied after it had been demonstrated that manual rotation of the head to the anterior oblique position could not be performed. With traction, the head was brought down as close as possible to the level of the lower sacrum and ischial spines, at which point a lateral laceration of the vaginal wall occurred adjacent to the left ischial spine. With gentle traction, the head became better flexed and, on removing the forceps, it was possible to rotate the head manually to an oblique anterior position, *because a well-flexed head can rotate in any type of pelvis*, Fig. 44. After this degree of rotation had been obtained, the delivery was easily accomplished by the use of Haig-Ferguson forceps, the head slowly rotating in a spiral manner to an anterior position. The lateral laceration of the vagina increased in extent as the head approached the outlet.

6B. FETAL PELVIC ADAPTATION

The position in which the head lies before or at the onset of labor is not necessarily determined by the shape of the pelvis, unless the head is already deeply engaged at that time. When the head is not deeply engaged, certain factors in the soft parts, which cannot always be determined in the individual case, influence the position. Such factors may be the shape or obliquity of the uterus, the position of the placenta, or even the length of the cord.

Thus we find posterior positions occurring in normal pelves and, with the onset of labor, descending in this position, according to the normal mechanism, to rotate spontaneously in the muscular gutter of the outlet. In certain pelvic types, however, engagement of the head in the position originally present at the inlet would result in arrest before engagement could be effected, unless adaptation to a more suitable position occurred. Representative examples are illustrated in Figs. 45 to 48. In Fig. 45 an original oblique posterior position rotated to a transverse position (Fig. 46) as engagement occurred. Such adaptation is necessary in this platypelloid (flat) pelvis or in the android type with a flat tendency. In Figs. 47 and 48, the pelvis conforms to a fairly typical anthropoid type with a narrow fore pelvis. An original anterior oblique position was maintained, without descent, until membranes ruptured with cervix fully dilated, at which time the vertex spiraled posteriorly to an oblique posterior position and descended into the low posterior pelvis. The rounded occiput avoids a narrow fore pelvis, and this necessitates engagement in the posterior position if the anteroposterior diameters

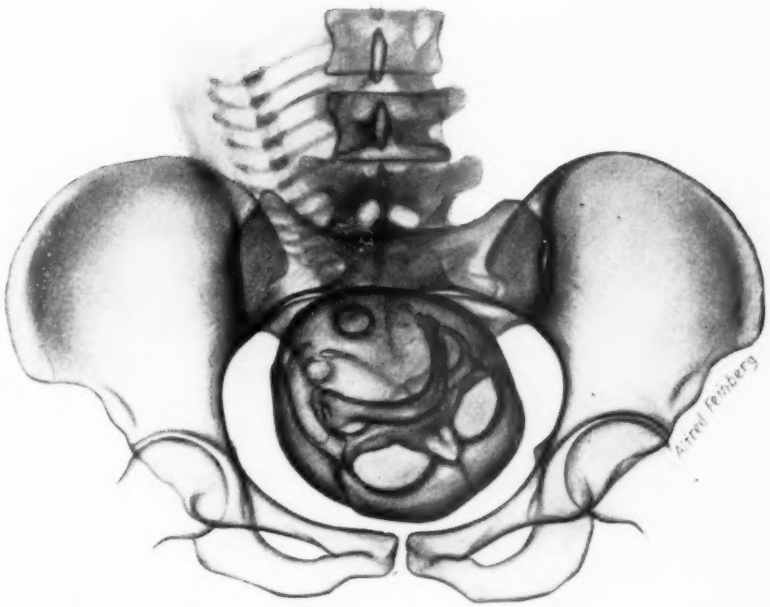

Fig. 45.—Fetal pelvic adaptation at the inlet. An original posterior position in a flat type of pelvis. This position is caused by the soft parts.

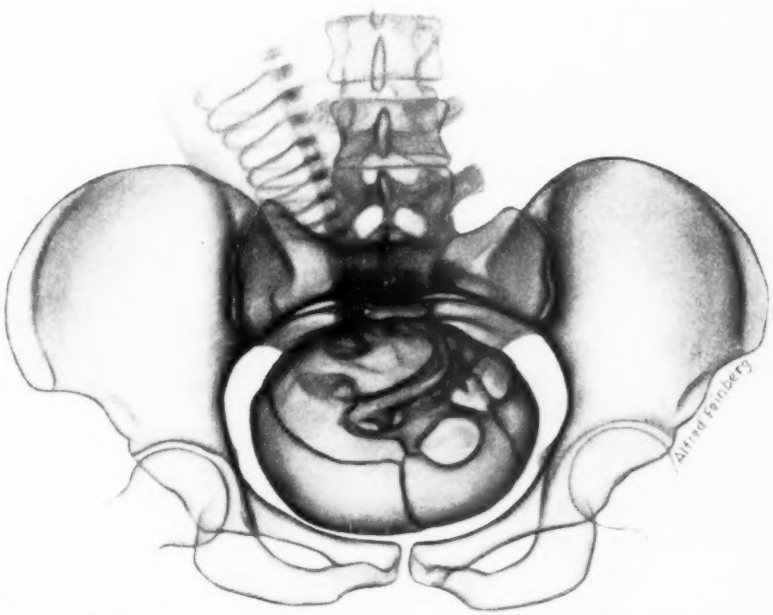

Fig. 46.—Fetal pelvic adaptation at the inlet. Same case as Fig. 45. For engagement to occur the head must adjust itself to the inlet to a transverse position. This latter position is maintained to a low level for reasons illustrated in Figs. 38 to 41.

Fig. 47.—Fetal pelvic adaptation at the inlet. An anterior oblique position at the inlet in an anthropoid type with a narrow fore pelvis.

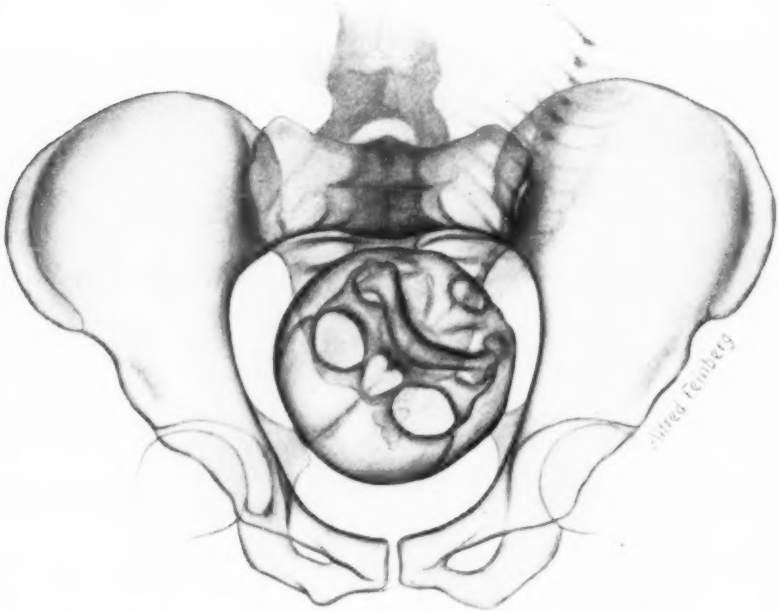

Fig. 48.—Fetal pelvic adaptation at the inlet. Same case as Fig. 47. The head, remaining high until membranes ruptured, engaged and rotated in a spiral manner to an oblique posterior position. The occiput is not as adaptable to a narrow fore pelvis as is the frontal aspect of the head.

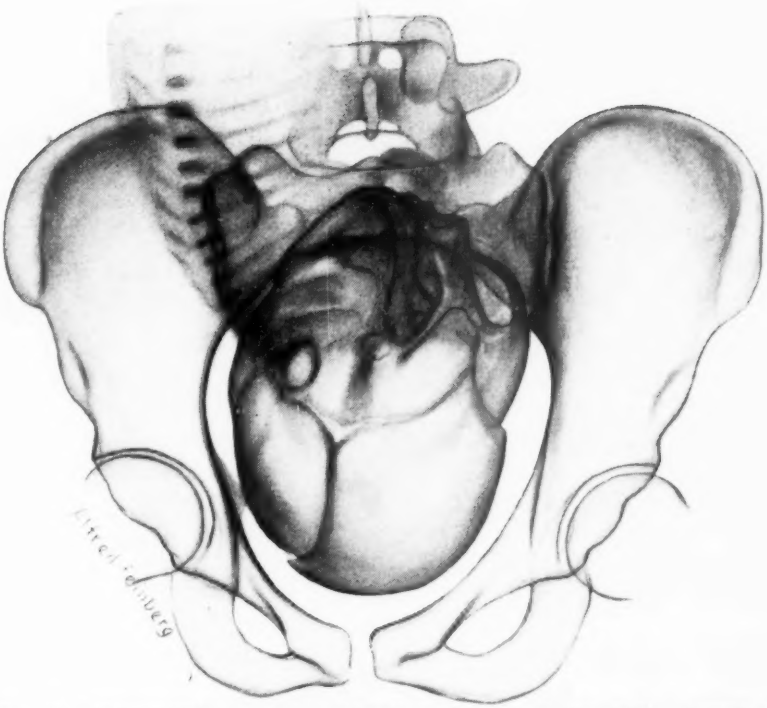

Fig. 49.—Abnormalities in the mechanism of labor at the inlet. Arrest of an anterior oblique position in an anthropoid type with a narrow fore pelvis. Appearance of the head (inlet view) wedged in the narrow fore pelvis in an oblique anterior position.

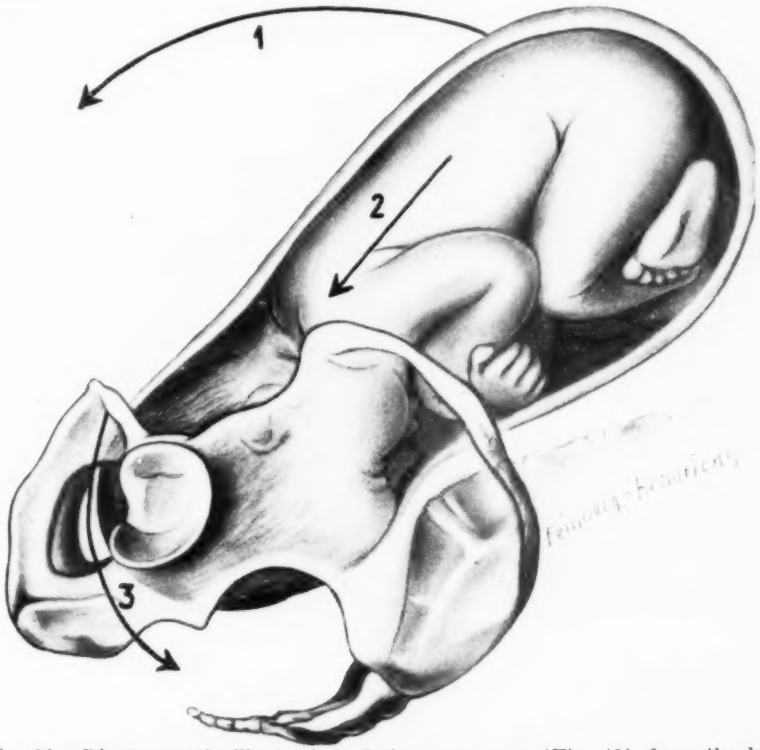

Fig. 50.—Diagrammatic illustration of the same case (Fig. 49) from the lateral aspect. The head is impacted in the narrow fore pelvis. Thus the uterus is prevented from swinging forward, and the head cannot move downward and backward to utilize the available posterior pelvis as in the normal mechanism of labor.

are long, as in the anthropoid type. In certain pelves with a narrow fore pelvis and a wide posterior pelvis, as in the android type, engagement will occur in the transverse position in order to avoid the narrow angle in the anterior part of the inlet. If considerable narrowing exists in the transverse diameter posteriorly, the head may not be able to enter even in the posterior position. Under these conditions, the head is forced to descend into the fore pelvis in an anterior position, as illustrated in Figs. 49 and 50. The head, in this case, descended obliquely downward and forward and finally arrested in the upper midpelvis, becoming wedged in the narrow fore pelvis. The uterus and fetal axis could not swing forward to make the head descend posteriorly toward the sacrum, as in the normal mechanism of labor. A difficult forceps delivery, resulting in a stillbirth, occurred, and it was mechanically difficult to direct the head downward and backward to make it utilize the posterior pelvis, as it does in normal labor. Traction virtually was made down through the fore pelvis before either the pubic or sacral segment of the soft parts had dilated and retracted. In this case, version and breech extraction would have allowed the head to utilize the posterior pelvis to better mechanical advantage.

6c. THE TYPE OF PELVIS ASSOCIATED WITH THE PERSISTENT POSTERIOR POSITION

Considering the volume of literature which has accumulated during recent years on the posterior position, it would seem that very little remains to be discussed concerning etiology or treatment of this obstetric problem. DeLee,[11] for instance, has accurately described the peculiar pelvic canal commonly found in persistent posterior positions, while the importance of the narrow interspinous diameter has long been recognized. At this time, space permits only brief discussion of the particular type of pelvis commonly associated with a persistent posterior position, and the type of pelvic canal which may permit either an efficient or inefficient uterine drive into the pelvic cavity through the fetus.

In Figs. 51 and 52 a posterior position is illustrated which has descended to a low level, with caput showing, at the time the roentgenograms were obtained, from which these diagrams were constructed. Presumably, the head, in spite of the shape of the pelvis, has descended through the pelvis according to the principles described above for the normal mechanism of labor. In all likelihood, the patient would eventually have delivered in a persistent posterior position if the condition had not been recognized. The pelvis in this case conforms to the android type with an anthropoid tendency. In other words, it possessed a long narrow fore pelvis, which insures a long

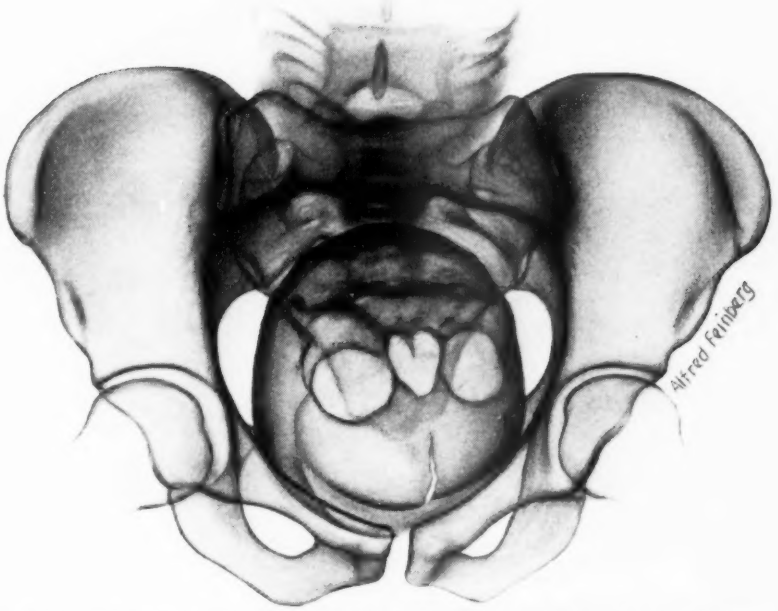

Fig. 51.—The type of pelvis associated with the persistent posterior position. The persistent direct O P position low in the fore pelvis (inlet view). The pelvis conforms to the *android type with anthropoid characteristics, converging side walls, and possesses a narrow interspinous diameter.*

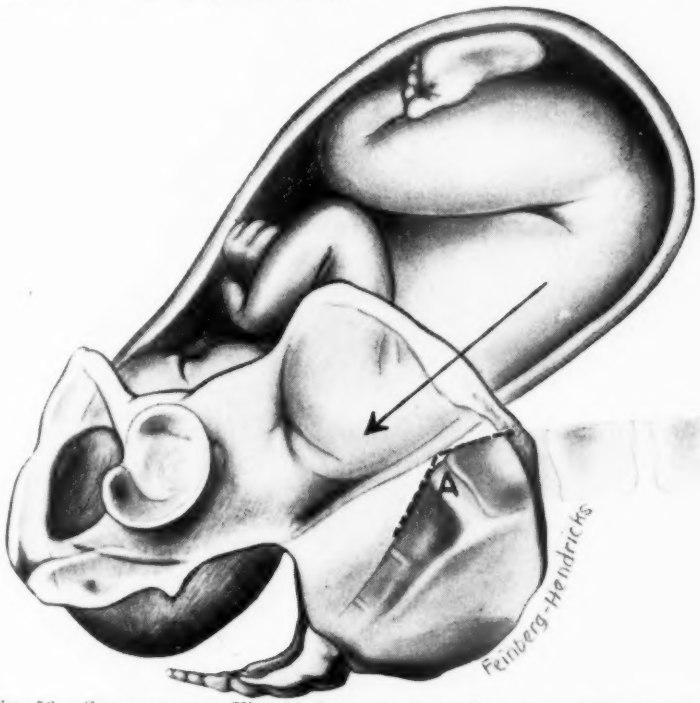

Fig. 52.—Same case as Fig. 51 from the lateral aspect. The normal mechanism of labor has been followed, and descent has occurred to a low level, largely, we believe, because the uterine contraction has been enabled to exert its influence as a straight drive through the fetus because of the wide angle at *"A."*

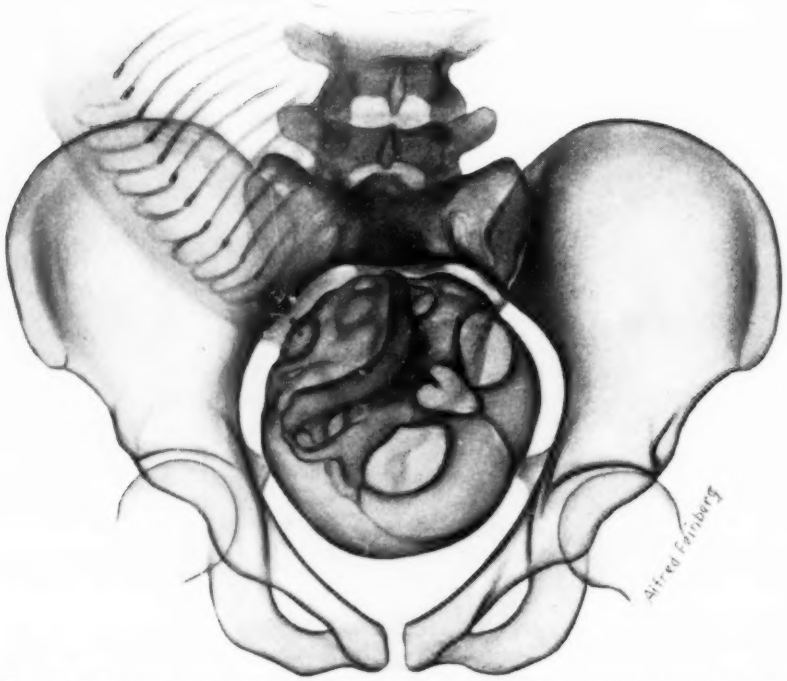

Fig. 53.—The type of pelvis associated with a persistent posterior position. Arrest of the head at bottom of posterior pelvis in the oblique O P position. The pelvis conforms to the *typical anthropoid type with straight side walls and a moderate outlet.* The fore pelvis is avoided. The head is impacted close to the sacrum and side walls of the pelvis.

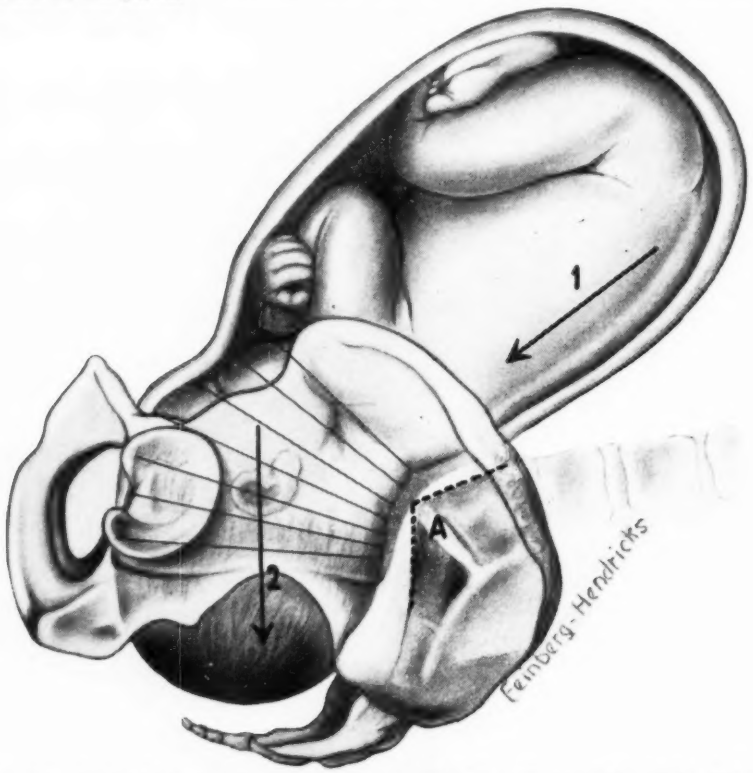

Fig. 54.—Lateral view of same case as Fig. 53. Tense soft parts hold head against sacrum. The sharp angle at *"A"* prevents the uterus from gaining a direct drive through the fetal piston into the posterior aspects of the pelvis. Note the posterior angle between axis of fetal body (1) and head (2).

anteroposterior diameter in spite of the android posterior pelvis. The side walls of the pelvis, in addition, converge toward a moderately narrow subpubic angle, causing noticeable narrowing of the interspinous diameter. These facts undoubtedly introduced sufficient resistance to the head to prevent rotation after descending through the pelvis in the oblique posterior position. The lateral view shown in Fig. 52 helps to explain the reason for this low and rapid descent. Notice that the lumbosacral angle at "*A*" is wide, so that the uterine drive in the fetal axis was efficient. In all probability, if the pelvis were more oblique to the vertebral column, as in Fig. 54, arrest would have occurred at a higher level. In this case, the well-flexed and well-molded head was easily rotated manually after the impaction was relieved by elevation of the head.

A posterior position which required forceps delivery is illustrated in Figs. 53 and 54. The pelvis conforms to a large anthropoid type with a definitely narrow transverse diameter throughout the pelvis, but with straight lateral walls and a moderate subpubic angle. The head became arrested at the level of the spines in the position shown in Fig. 53. Note that the head has descended, avoiding and not using the fore pelvis. It is situated so close to the sacrum and side walls, in the oblique posterior position, that attempts at manual and instrumental rotation were unsuccessful, due to the impacted condition. The cervix was almost completely dilated, but a thick, tough rim encircled the head. Forceps were finally applied pelvically with the head in the direct O P position and, with traction, the caput appeared. The lateral diagrammatic view of this case in Fig. 54 reveals an important factor in the lumbovertebral angle and the type of pelvic obliquity which we believed materially furthered the arrest. Note that the angle at "*A*" between the lumbar column and sacral surface is more acute than the example shown in Fig. 52. This anatomic arrangement predisposed to less flexibility at the lumbosacral joint, so that even with the lithotomy position the fetal axis could not be brought to bear directly downward into the posterior pelvis. In other words, the pelvis is more oblique to the vertebral column, and the fetus in its descent must "round" a sharp bend in order to descend through the pelvis. With the head at a higher level, the uterine drive, in spite of this abnormality, was sufficiently good to cause descent. Finally, as descent occurred, an increasing posterior angle between neck and body resulted. This prevented the transmission of the uterine force to the occiput, and contractions diminished in frequency and strength. Coincident with these results, the lower pole of the uterus became spastic, the rim of the cervix became edematous, and the descent finally ceased, with the head impacted and fixed against the lower sacrum, Fig. 54.

A roentgenogram, which illustrates to even better advantage the rôle normally played by the lower pole of the uterus in directing the head into the posterior pelvis and maintaining it close to the sacrum, is shown in Fig. 55. The pelvis conforms to the anthropoid type. The head, in the oblique posterior position, is not making use of the fore pelvis, but is located above and behind the ischial spines. In this example, spontaneous rotation of the posterior position occurred

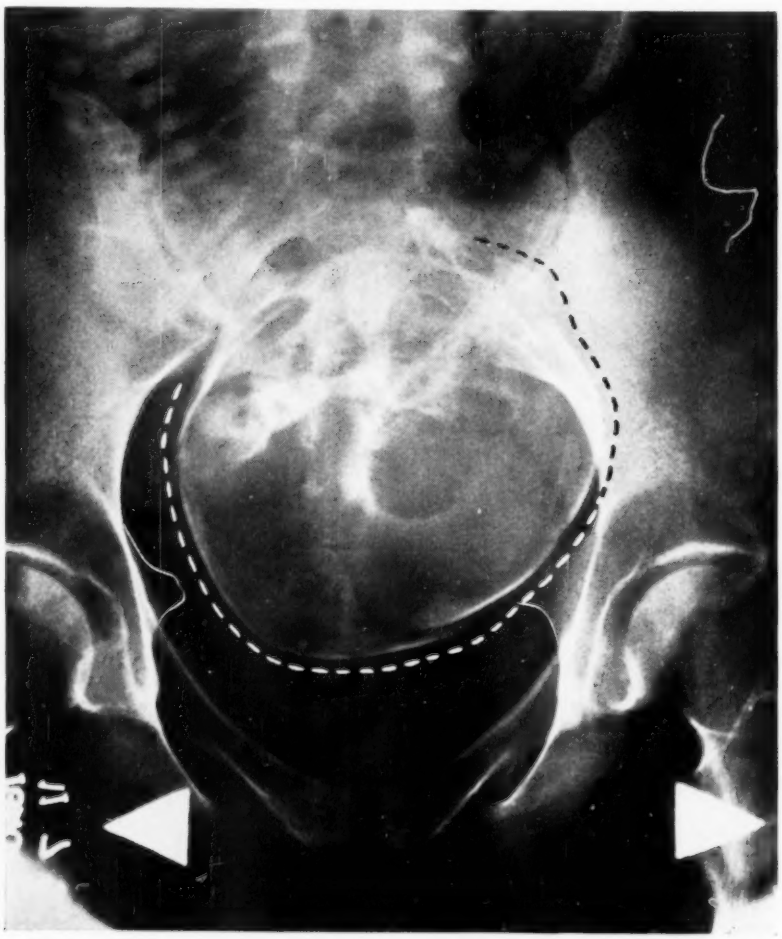

Fig. 55.—A roentgenogram of an oblique posterior position which has descended to the midpelvis. The pelvis conforms to the anthropoid type. The lower pole of the uterus (outlined diagrammatically) directs the head into the more ample posterior pelvis above and behind the ischial spines, thereby avoiding the fore pelvis at higher levels. This principle concerning the rôle of the lower pole of the uterus applies to all pelvic types.

after the head had descended to the bottom of the posterior pelvis. A lateral roentgenogram of the same case revealed a pelvic canal similar in shape to Fig. 52.

Several examples of secondary posterior positions have been encountered which caused considerable difficulty in rotation in the lower

posterior pelvis. A representative case study is illustrated in Fig. 56. The pelvic type conforms to the gynecoid or normal type, but with the ischial spines protruding sharply inward to create a narrow interspinous diameter without affecting other transverse measurements in the pelvis. The head descended rapidly to the level of the spines, following the normal transverse mechanism (O T posterior parietal at inlet). At this point, the narrow interspinous diameter caused the occiput to rotate posteriorly and, as further descent occurred, the occiput became fixed behind the spine in the lower aspects of the sacrosciatic notch. Attempts at manual and instrumental rotation at that level were unsuccessful. Manual rotation was easily carried out after the head had been pushed up sufficiently to clear the ischial spines.

Fig. 56.—Arrest of the head in the O P position behind a narrow interspinous diameter, while the pelvis, generally, is quite ample. The head descended as a transverse position to the level of the spines and rotated to the oblique posterior position behind the spines as illustrated.

In addition to the case studies illustrated in Figs. 51 to 56, we have investigated the type of pelvis associated with spontaneous face to pubes deliveries. As a rule, the pelvis reveals one or more of the following characteristics:

1. An ample, but fairly typical anthropoid pelvis, with a subpubic angle of any size.

2. An ample android pelvis with a long fore pelvis which introduces the anthropoid tendency.

3. A definitely narrow angle in the fore pelvis at the inlet, with a posterior pelvis conforming to the gynecoid, android, or anthropoid type.

4. Converging side walls of the fore pelvis, with a narrow subpubic angle.

5. An obtuse lumbosacral angle, with a pelvic canal similar in shape to the example illustrated in Fig. 52.

The pelvis associated with a persistent occipitoposterior position which requires some form of operative delivery displays, as a rule, a combination of several of the characteristics listed above. The shape of the pelvic canal, as viewed from the lateral aspect, tends to conform to the example illustrated in Fig. 54, in which the acute angle at "*A*" prevents an efficient uterine drive along the fetal axis into the posterior pelvis.

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875 Park Avenue

Farber and Hubbard: Fetal Endomyocarditis: Intrauterine Infection as the Cause of Congenital Cardiac Anomalies, Am. J. M. Sc. **186**: 705, 1933.

In the hearts of a number of infants who showed evidences of congenital heart disease at postmortem examination, the authors have found areas of fibrosis, cellular infiltration, and calcium deposition. These changes, they believe, represent the end-results of inflammatory processes which, in view of the age of the patients, must have occurred during intrauterine life.

Classifications of congenital heart disease usually list the various anamolies under two general headings: (1) Those due to primary defective or arrested development, and (2) those due to infection transmitted to the fetus from the mother at some time after the third fetal month, when the heart is believed to assume its adult form. In these cases, the septa are free from defect, the essential relationships of the chambers and great vessels are normal and the chief abnormalities consist of stenosis, or atresia of the valves. It is now generally accepted that myocardial changes are also of importance. Careful investigation of the myocardium in most cases of atresia of the orifices will reveal patchy yellowish gray areas visible to the naked eye, which microscopically show all stages of degeneration, vacuolation, fatty change, calcification with cellular infiltration, and a diffused fibrosis, which is often myxomatous in character. Four cases are reported.

J. Thornwell Witherspoon.

THE TREATMENT OF CARCINOMA OF THE CERVIX BY WERTHEIM'S OPERATION*

VICTOR BONNEY, M.S., B.Sc., F.R.C.S., LONDON, ENG.

I ESSAYED my first Wertheim's operation in 1907 and from then up to the present time I have performed it 483 times. From the beginning the operation I have performed has been as drastic as possible including the removal of most or all of the vagina and the routine extirpation of the regional glands. Except where the patient was very old or the subject of advanced cardiac, pulmonary, renal, or other systemic disease, I have operated whenever I thought there was any chance of completing the operation. This practice has compelled me to cope with many growths at the very limit of operability and on various occasions to close the abdomen without attempting the obviously impossible, or desisting from the attempt after it was begun.

The principle I have worked on has had the disadvantage of raising both the operative mortality and the recurrence rates, but on the other hand it has enabled me to save lives that would otherwise have been lost and to present results which I believe represent the limit to which pure surgery can go in the treatment of carcinoma of the cervix.

I have not employed preoperative radiation, but a few of my earlier cases were sent to me as having been "rendered operable" by radium. The operations were exceedingly difficult and none of the patients survived five years. I have employed postoperative radiation only in those cases where it was found impossible to remove carcinomatous glands from the iliac vessels. Not one of these patients survived five years. The successes I am able to record are therefore the fruit of surgery and surgery only.

I will first give you my results on the basis of five years' freedom from recurrence so that they may be compared with the statistics of radiology, and afterward on the basis of ten years' freedom from recurrence, because 10 per cent of all recurrences appear between the fifth and tenth year. Five years' freedom from recurrence is only a 90 per cent cure, but ten years' freedom is a 100 per cent.

I have classified my cases according to whether the regional glands removed at the operation were or were not carcinomatous. Such a classification gives a good indication of the average advancement of the primary growth in the two groups respectively; but though in

*Read, by invitation, at the Sixtieth Annual Meeting of the American Gynecological Society, Hot Springs, Va., May 27 to 29, 1935.

cases in which the regional glands are involved the primary growth in the cervix is on the average of older standing and more extensive than in cases in which the regional glands are not involved, there is no hard and fast rule and extensive glandular involvement may coexist with a very small primary growth in the cervix, whilst conversely the cervical growth may be most extensive without any involvement of the regional glands. I have not adopted the classification that obtains in radiology, in the first place because my series was begun before radiology appeared in the field, and in the second because no useful comparison can be drawn between what one man sees and another man thinks he feels.

RESULTS ON THE FIVE-YEAR BASIS, 1907-1929

Died of operation	55
Lost sight of within five years	12
Died other diseases within five years	12
Recurrence within five years	155
Well after five years	150
	384

The operative death rate of this series is 14 per cent. It was 20 per cent in my first hundred operations but has progressively fallen owing to increased experience and various precautions. For the last 200 operations I have performed it is 9.5 per cent.

If the patients lost sight of and dying of other disease within five years of the operation are reckoned as having died of recurrence the five-year cure rate is 39 per cent, or if (as I think more properly), they be dismissed from the calculation, between 41 and 42 per cent.

RESULTS ON THE FIVE-YEAR BASIS CONTINUED, 1907-1929

The effect of glandular involvement:

	GLANDS NOT INVOLVED	GLANDS INVOLVED
Died of operation	22	33
L. S. O. within five years	6	6
Died other disease within five years	10	2
Recurrence within five years	71	84
Well after five years	114	36
	223	161

It will be noted that the regional glands were carcinomatous in 42 per cent of the cases. This figure roughly accords not only with the gland involvement rate of all my cases but also with that of the cases operated on by my colleague, Comyns Berkeley. It goes up and down a little according to the incidence of chance, but it can with certainty

be said that of the patients presenting themselves with carcinoma of the cervix at least 40 out of every 100 already have carcinoma in the regional glands. The difference in the prognosis of the two groups is very striking. The cases whose regional glands were growth-free ran on the average an operative death risk of 9.8 per cent, in return for which they gained, depending on which of the two reckonings referred to is employed, a 51 or 55 per cent chance of five-year survival; whereas on the average cases whose regional glands were carcinomatous ran a death risk of 20 per cent to gain a 22 or 23 per cent chance of five-year survival. On the other hand the contention of certain authorities that the routine removal of regional glands is unwarranted because cases in which they are carcinomatous almost always die of rapid recurrence is disproved, for my figures show that about 23 per cent of these gland-involved cases may be expected to survive five years.

Up to the end of 1924 I had performed Wertheim's operation 283 times with the following results:

RESULTS ON THE TEN-YEAR BASIS, 1907-1924

Died of the operation	47
Lost sight of within ten years	23
Died of other disease within ten years	12
Recurrence within ten years	119
Well after ten years	82
	283

The operative death rate of this series is 16 per cent, a higher figure than that of the series previously dealt with because it contains a larger proportion of my early cases. The proportion of cases lost sight of is increased owing to the difficulty of keeping in touch with patients over so long a period. Similarly there is an increased proportion of deaths due to causes other than recurrence. The labor of keeping in touch with my patients has been mine, for it is only of quite recent years that follow-up departments have been instituted in Great Britain, and even now they are imperfect. The reason is the expense which places another burden on institutions already financially strained. If these patients who were lost sight of and dying of other disease are reckoned as having died of carcinoma the ten-year cure rate is 20 per cent, but if they be dismissed from the calculation, as in my opinion they certainly should be, it is 33 per cent. Ten-year cures are to be regarded as absolute cures. It is not, of course, impossible for recurrence to take place after that lapse of time, but I have not met with it.

THE EFFECTS OF GLANDULAR INVOLVEMENT

RESULTS ON THE TEN-YEAR BASIS CONTINUED, 1907-1924

	GLANDS NOT INVOLVED	GLANDS INVOLVED
Died of operation	19	28
L. S. O. within ten years	17	6
Died other disease within ten years	10	2
Recurrence within ten years	53	66
Well after ten years	59	23
	158	125

As in the five-year series there is a marked difference in the results obtained from the two groups. The operative mortality of the gland-free group is 12 per cent as against 22 per cent for the gland-involved group, while, according to the method of reckoning, the ten-year cure rate is 37 or 45 per cent as against 18 or 20 per cent. The higher gland involvement rate (44 per cent) must be fortuitous, for my method of selection has never varied, nor have I observed that patients in more recent years present themselves earlier in spite of modern propaganda.

ACTUAL OPERATIVE ACHIEVEMENT

In order to assess the actual achievement of any series of operations for carcinoma it is necessary to know the surgeon's operability rate, i.e., the percentage of patients selected for operation out of every 100 seen. For some years after Comyns Berkeley and I had begun to perform the operation, we were able to estimate our operability rate with accuracy at 63 per cent, for we were the only surgeons in our hospitals performing the operation at that time, and we had complete command over the clinical material presented to us. In later years, however, for several reasons we lost that command and it became impossible to disentangle the cases in which we determined the treatment from those in which the treatment had been determined by others. In all our subsequent communications we continued to reckon our operability rate as being 63 per cent, feeling justified in doing so because our operative practice never varied.

There is one group of my cases on which I can speak with complete certainty in this matter, namely, the patients whom I have seen in my consulting room and over whose treatment I have therefore had entire determination. Between the years 1907 and 1930 I operated on 80 per cent of these. In the reckoning of my actual operative achievement which I am now going to give you I shall assume as heretofore my operability rate to be 63 per cent.

On the basis of five years' freedom from recurrence my actual operative achievement is 24.6 per cent if the cases lost sight of and died of

other disease within five years are reckoned as having died of recurrence, or 25.6 per cent if they are excluded from the calculation; while on the basis of the ten years of freedom from recurrence the figures are 18 per cent, or just on 20 per cent. The value of the operation may therefore be briefly expressed by saying that on the five-year basis it cures 2 out of every 5 patients operated on, and 1 out of every 4 patients seen; whilst on the ten-year basis it cures one out of every 3 patients operated on and 1 out of every 5 patients seen.

It is apt to be forgotten that the number of cures effected by the operation is not the same thing as the number of cures to the credit of the surgeon who practices it, for besides those patients he operates on there remains a residuum which he treats by radiation. If he operates on 63 out of every 100 patients presented to him there are 37 of these.

Except for a small proportion where the operation was forbidden not because it was mechanically impossible but on account of the woman's general physical state, all these patients are the subject of advanced disease and come under Class III and IV of the Radiological Classification. Five of these 37 patients, i.e., 5 per cent of the 100 originally seen, may be dismissed from consideration as beyond the reach of any measures. Out of the 32 remaining a certain proportion of five-year cures can be obtained by radiation; judging from Radiological statistics about 5, and this number has to be added to the number of five-year cures by operation. A surgeon, therefore, who deals with his cases of carcinoma of the cervix as I have dealt with mine may expect to obtain 29 to 30 five-year cures out of every 100 unselected cases that he sees.

The operation as I do it is performed as follows:

Under full ether and spinal anesthesia the patient is placed in the lithotomy position, and a catheter having been passed, the vagina is tightly packed from the vault downward with gauze soaked in "Violet-Green."* The patient is then fixed in the Trendelenburg position and the abdomen is opened in the middle line.

Ligatures are now placed on both ovariopelvic ligaments and on both round ligaments, and a clamp having been placed just outside the uterine cornu on each side, the upper parts of the broad ligaments are divided just inside the ligatures (Figs. 1, 2, and 3).†

The freed appendages are now ligatured as they come off from the uterus, and the ends of the ligatures are left long. A forceps is placed on the ends, thus making a convenient tractor (Fig. 4).

The peritoneum across the front of the uterus is now divided and an anterior flap is reflected until the bladder is reached. The bladder is now separated from the vagina partly by thumb pressure and partly by scissors (Fig. 5).

*One per cent of equal quantities of crystal violet and brilliant green dissolved in equal parts of 95% alcohol and water. A 1 per cent solution of flavine in water can be used if "violet-green" is not available.

†The illustrations have been redrawn by Mr. Bonney from the *Textbook of Gynecologic Surgery*, by Sir Comyns Berkeley and Victor Bonney, Cassel & Co., London, 1935.

The separation at this stage should not be continued further than an inch downward, for it is better to effect the complete separation step by step as the operation proceeds.

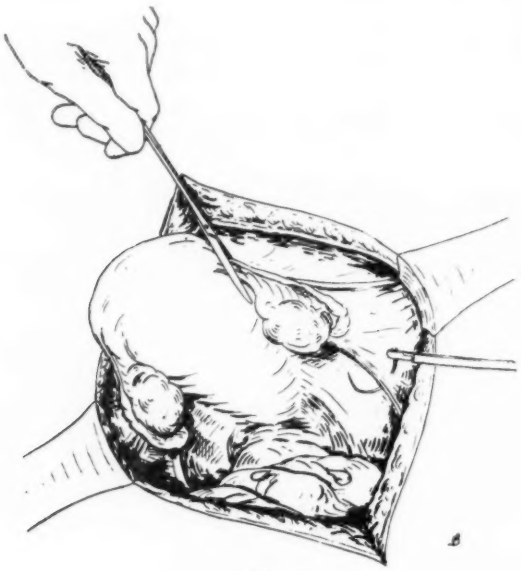

Fig. 1.

Fig. 2.

The peritoneal flap should be sutured to the lower angle of the abdominal wound to keep it out of the way.

The next step is to open up the broad ligament and define the external iliac vessels. To do this forceps should be attached to the stumps of the ovariopelvic and round ligaments and the loose areolar tissue of the broad ligament teased aside until the vessels are clearly seen.

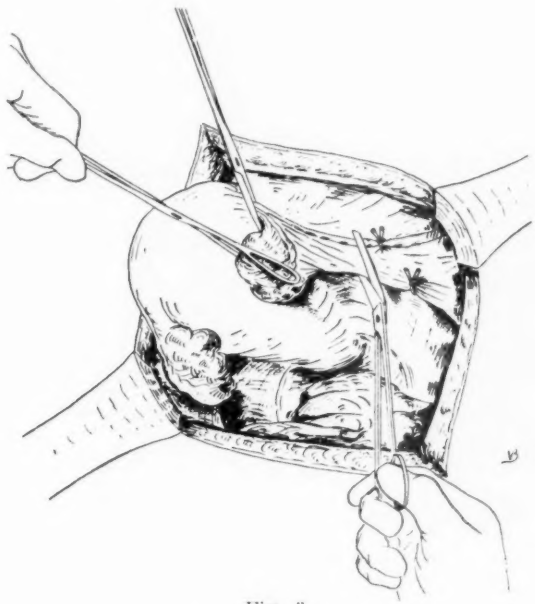

Fig. 3.

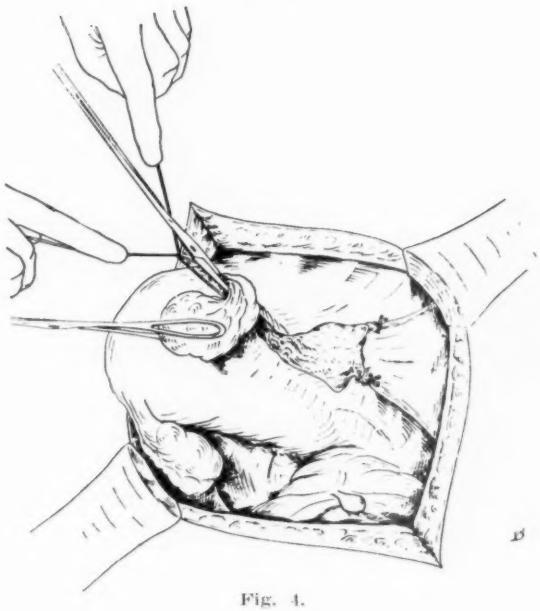

Fig. 4.

The ureter should now be felt for with the thumb and index finger on either side of the posterior layer of the broad ligament to which layer the ureter clings. It can generally be seen as well as felt (Fig. 6).

The uterine artery is now sought. The internal iliac artery and its continuation forward as the hypogastric must first be defined. The uterine artery comes off the hypogastric artery, usually at right angles, and, in easy cases with a little teasing aside of the areolar tissue, is readily seen (Fig. 7). In more difficult cases the index finger should be thrust down into the broad ligament between the ureter previously

Fig. 5.

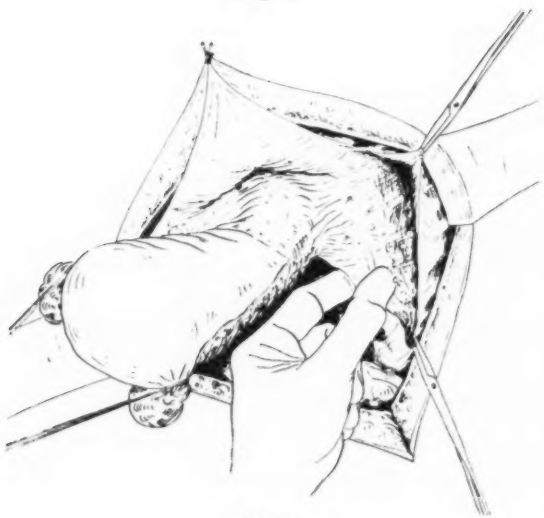

Fig. 6.

defined and the internal iliac artery also previously defined, and the fingertip exploring forward is made to underburrow and hook up the artery which with a little experience can easily be felt.

The artery is now divided between two forceps, and the uterine end being rucked back, the ureter will be perceived running under it (Fig. 8). It should be followed up until it disappears into the ureteric canal.

The tip of the left index finger is now pushed along the canal and the roof of the canal cautiously divided (Fig. 9). The tissue inside the ureter which holds it against the vagina is now divided down to the ureterovesical junction, and the ureter is rolled outward and finally completely raised from its bed, though the length of this raising should be kept as short as possible (Fig. 10).

Fig. 7.

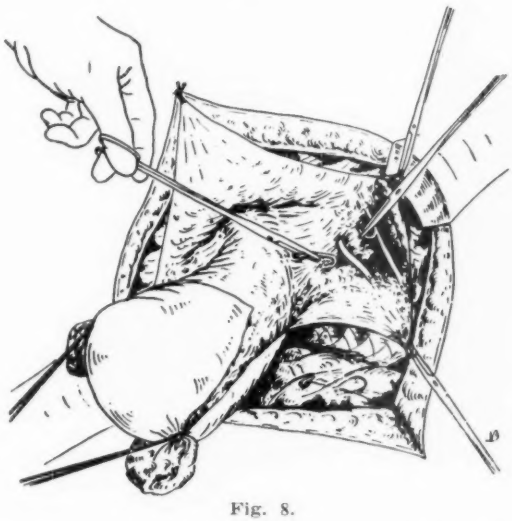

Fig. 8.

The same procedures are then carried out on the opposite side.

The uterus is now carried forward and the loose peritoneum on the front wall of Douglas' pouch is picked up and divided (Fig. 11).

The index and middle fingers of the left hand are now insinuated between the vagina and rectum, keeping the pulps against the packed column of the vagina until the two canals are separated almost or quite down to the pelvic floor (Fig. 12).

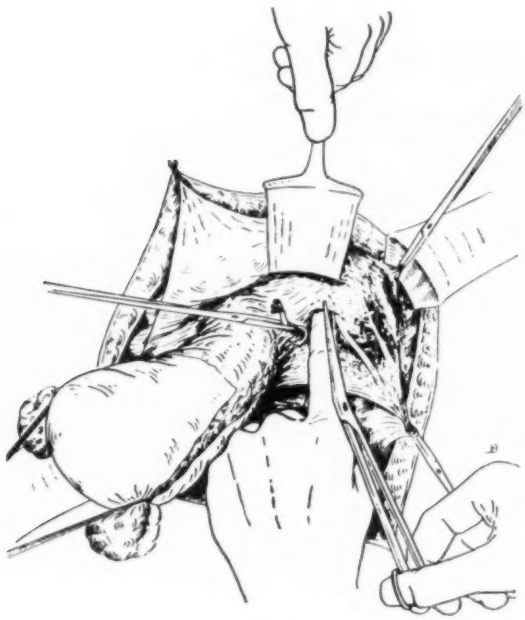

Fig. 9.

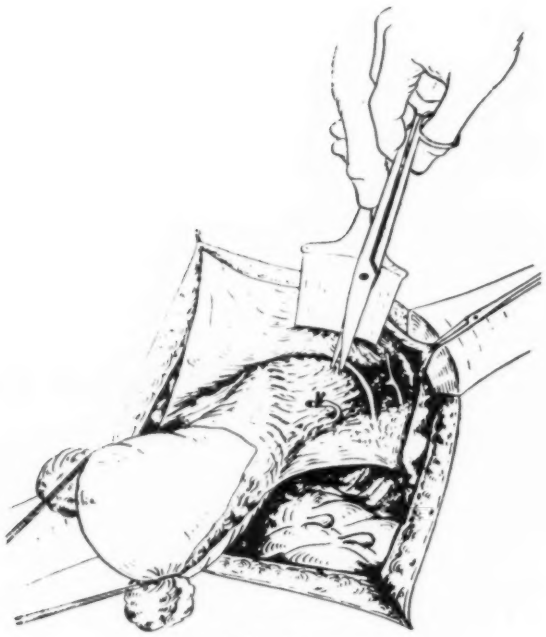

Fig. 10.

Fig. 11.

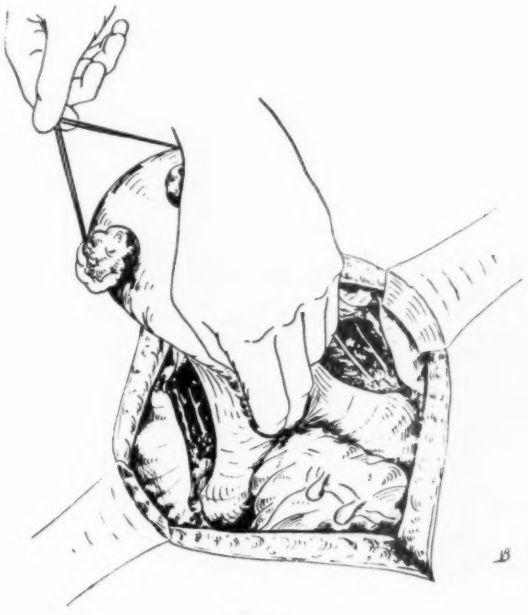

Fig. 12.

Fig. 13.

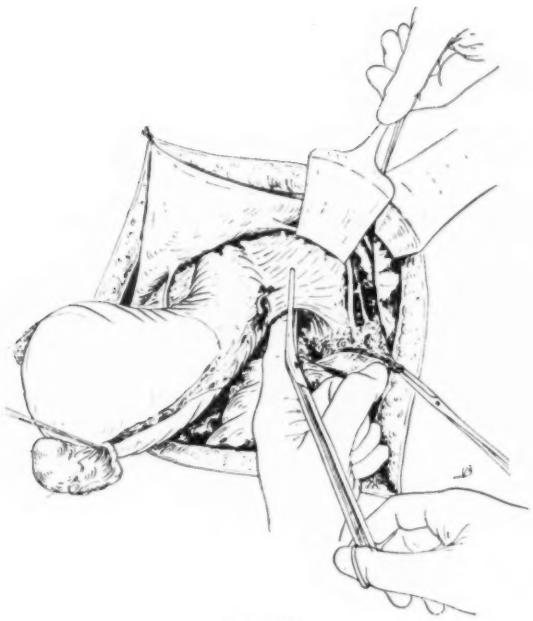

Fig. 14.

Fig. 15.

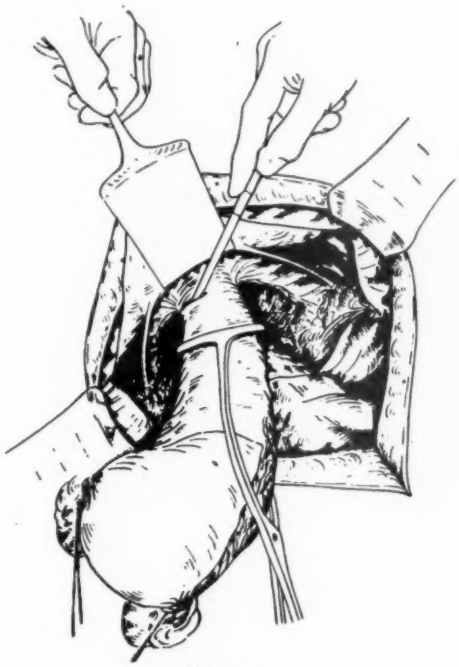

Fig. 16.

The remainders of the posterior peritoneal layers of the broad ligaments are now divided to meet the aperture in Douglas' pouch, care being taken not to divide the ureters which must be defined before using the scissors (Fig. 13).

The cardinal ligaments of the vagina are now accessible, to which achievement all the preceding steps of the operation have been leading up. They can be felt as two broad fan-shaped sheets extending from the sides of the vagina outward. The index finger of the left hand should be passed behind one of them and the ureter, which lies on it, having been thoroughly displaced outward and kept there by a retractor, the ligament is cautiously divided over part of its depth (Fig. 14).

A similar procedure is then carried out on the opposite side.

The uterus is then carried forward again and a further separation of the rectum and the tissues lateral to the rectum is carried out (Fig. 15) after which the cardinal ligaments are again turned to and still further divided. It is better to effect this division gradually, turning first to one side and then to the other. The severance should be carried out until the whole depth of the ligaments, or nearly the whole

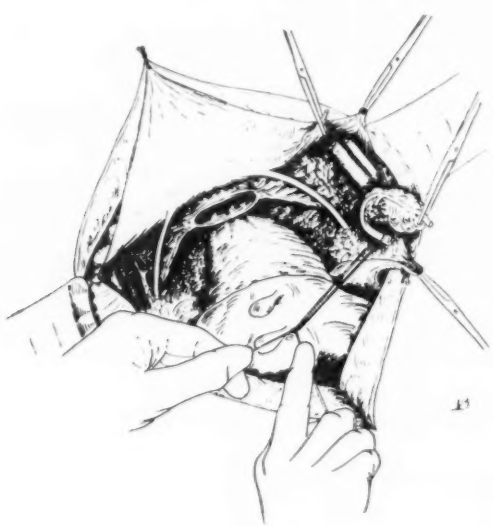

Fig. 17.

depth, down to the pelvic floor is divided. During the process the surgeon should alternate cutting the cardinal ligaments with further separation of the bladder, not only in the middle line but outward somewhat beyond the ureterovesical junctions.

The uterus and vagina are now only held by the attachment of the lower end of the latter to the pelvic diaphragm. The gauze in the vagina having been withdrawn, a Berkeley-Bonney clamp is applied well beneath the growth and the vagina divided as low down as the separation makes possible (Fig. 16). As a rule practically all the vagina is removed so that when the patient subsequently presents herself for inspection, the formation is similar to what obtains in a case of "imperforate hymen." It will be noted that no clamps are placed on the cardinal ligaments before division. They are unnecessary and hamper the operator. If a vessel bleeds during the division it should be picked up with forceps.

As soon as the removal is effected the pelvis should be wiped clear of blood and obviously bleeding vessels picked up and tied. It is a good thing as a routine to place a strong mattress ligature on the tissues immediately outside the lateral vaginal angle on either side, as there are nearly always bleeding vessels in these situations.

The regional glands are now to be removed. Those along the external iliac vein

should be separated inward and then raised together with the hypogastric artery. The artery is then divided at the lateral angle of the bladder and rucked back with the glands until the mass pivots on the anterior trunk of the internal iliac artery. This is then ligatured and divided (Fig. 17).

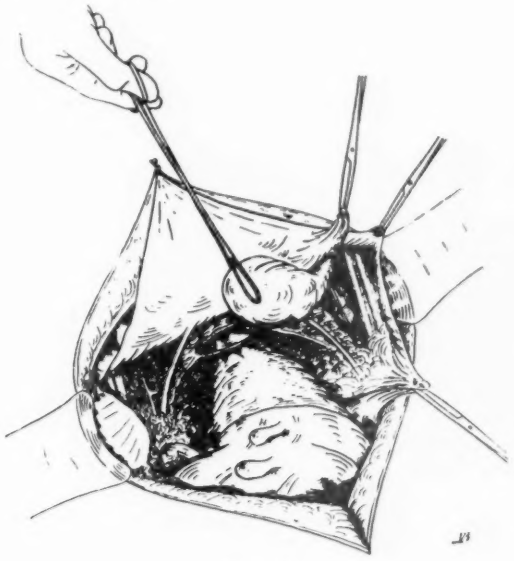

Fig. 18.

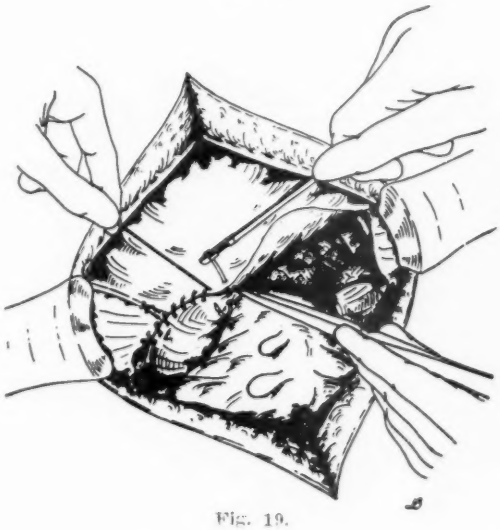

Fig. 19.

In early cases it is not necessary to do this, and the glands should be dissected off by themselves.

There now remain the glands in the obturator fossae. It is important to remove these as they are the first group to become invaded. They lie in a mass of fat which can both be seen and be felt inside the line of the hypogastric artery and below the external iliac vein. The obturator nerve passes through the mass of fat. The best way to separate this mass is by the fingers aided by "ring forceps."

With practice it can be extracted very cleanly and without bleeding. The obturator nerve should be separated out of it unless it is involved in growth. The mass of fat extends by a process downward to the brim of the pelvis under Poupart's ligament and when extracted the bare bone of the pelvis should be felt (Fig. 18).

The vagina, or rather what remains of the vagina, is left open and through it a strip of thin gauze previously soaked in flavine 1 in 1,000 is passed until it protrudes from the vulva. The rest of the length of gauze (about 2 feet) is lightly packed into the pelvis, after which the peritoneum is united across the pelvis by a continuous suture (Fig. 19). The gauze is removed via the vulva in from forty-eight to seventy-two hours.

Convalescence is conducted on the usual lines, but absolute retention of urine for from one to two weeks and sometimes longer always occurs and compels the regular use of a soft rubber catheter.

15 Devonshire Place

TUBERCULOSIS OF THE CERVIX UTERI*

Virgil S. Counseller, M.D., and Donald C. Collins, M.D.,
Rochester, Minn.

TUBERCULOSIS of the cervix uteri is very rare. We have partially reviewed the literature on this condition, and are reporting a complete study of a case, which was seen at the Mayo Clinic, in the hope that it may assist in the prompt recognition and early institution of adequate treatment.

Morgagni in 1744 was the first to describe tuberculous salpingitis and tuberculous endometritis; in his case, the patient was a girl, aged twenty years. He concluded that tuberculous pelvic disease may be the source of a generalized tuberculous peritonitis. Lisfranc is said to have presented the first case of tuberculosis of the cervix. In 1834 Boivin and Dugés wrote an excellent atlas of diseases of the uterus and its adnexa. In this work they clearly described for the first time a true instance of tuberculosis of the cervix uteri. Nine years later, Louis reported a clinical example of this condition. Kiwisch in 1847 described this disease with remarkable accuracy and clearly demonstrated his clinical knowledge of this condition. Geil completed his classic work on "Tuberculosis of the Female Genital Organs" in 1851. Little has been added to his description in the following eighty years.

Rudolph Virchow in 1853 carefully described instances of tuberculosis of the cervix. Friedländer shortly thereafter described another similar instance of primary tuberculosis, and his contention was verified by necropsy after the patient had died of an apoplectic seizure. At this point Rokitansky "muddied the waters" by declaring that tuberculosis of the cervix never occurred. So great was his authority that further investigation was stifled. Ten years elapsed before Lancereaux and Lackerbauer demonstrated beyond argument that tuberculosis of the cervix did exist and that it was usually secondary to pulmonary tuberculosis. In the following year, 1872, Lebert reaffirmed Rokitansky's opinion. His contentions were based upon only thirty-three cases of tuberculosis of the uterus and its adnexa,

*From the Mayo Clinic and the Mayo Foundation.
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which he had observed personally. As later investigations have demonstrated, his series of cases was entirely too small to warrant such sweeping conclusions.

The next important contribution was made by Cohnheim in a small book, which was published in 1879. He said that tuberculosis of the cervix could easily result from coitus with a tuberculous partner. This immediately popularized the entire subject and one again focused considerable attention upon it. Two years later, Lukasiewicz and Mayor reported examples of secondary tuberculous involvement of the cervix, in which there was an accompanying tuberculous endometritis. In 1883 Verneuil independently made observations, which were similar to those of Cohnheim. In this same year, Babés isolated the tubercle bacillus from the vaginal secretions of a patient, who had tuberculosis of the cervix, and definitely settled once and for all the etiology of this disease. In the following six years cases were reported by Winters, Derville, Cornil, Zweigbaum, Thiercelin, and Schmorl and Birch-Hirschfeld. In 1892, J. Whitridge Williams presented an exhaustive survey of this subject; this was one of the first reports to come from America. Additional data were added by Emanuel, Meyer, Sippel, Kaufmann, Weigert, Vassmer, and Ajello.

Beyea in 1901 completely reviewed the literature up to that date and tabulated his findings. He was able to collect 68 cases of proved tuberculosis of the cervix. Thirty of these were proved at necropsy, and were associated with advanced tuberculosis elsewhere in the genital tract. Two instances were found of primary involvement of the cervix. Twenty-two cases were observed clinically; 9 of these were believed to be cases of primary infection. Fifteen of the entire 68 cases were studied both clinically and at necropsy; all of these cases were found to have foci of active tuberculosis elsewhere in the body. Thirty-six of 57 patients were found to be between twenty and forty years of age, which is the period when the female genital tract is at the height of its functional activity. In a group of 56 cases, the correct diagnosis of tuberculosis was made in 28 cases, while the diagnosis of malignancy of the cervix was made in 17 cases.

In the next two years, additional cases and important data were presented by Horrocks, Croft, Levers, Brook, and Kynock. John B. Murphy in 1903 and 1904 exhaustively reviewed this entire subject and brought all the data up to date. His contributions to this field were thorough and little has been added to our knowledge since his publications. Four years later, Vineberg was able to find only 22 cases of primary tuberculosis of the cervix recorded in the literature. He added a secondary case. Neu urged the employment of radical surgical procedures to bring about the highest percentage of permanent cures. Horizontow said that in 14 per cent of his specimens of pelvic tuberculosis the cervix uteri was involved. In 1916, Cullen reported a very early example of this disease in the case of a young negress, who complained of the spontaneous development of a rectovaginal fistula that had been present two years. Moore presented an excellent review of the literature up to 1919 and added an additional case of the secondary type.

Greenberg, in a review of the literature, in 1920 reported that in a series of 897 cases of pelvic tuberculosis there were 37 cases (4.2 per cent) that revealed tuberculosis of the cervix uteri. Norris, Wharton, Spalding, Neuwirth, Culbertson, Daniel, Schmidt, Pavlovsky, Bengolea and Pavlovsky, Gupta, Douglas and Ridlon, White, Bishop, Harris, Dworzak, and Bonnet and Builliard made notable contributions to this field in the next eleven years. Davis studied 1,200 cervices, which had been removed surgically; 777 of these disclosed evidence of inflammation, but the inflammation was tuberculous in only one specimen. On the other hand, 25 (5.7 per cent) additional specimens of this same group were carcinomatous. In the last two years, noteworthy articles upon this subject have been presented by Sasaki, Davis, and Watson.

In 981 reported cases of genital tuberculosis among women, there were 39 (0.4 per cent) instances of tuberculosis of the cervix. Of these 39 examples, 3 (7.7 per cent) were undoubted primary tuberculous infections. About 40 per cent of the recorded cases of tuberculosis of the cervix were associated with active pulmonary tuberculosis. Williams expressed the opinion that one of every 600 women who had tuberculosis of the lungs, later developed tuberculosis of the cervix. In the pathologic examination of 22,335 operative specimens reported in the literature, there were only 4 (0.027 per cent) proved examples of this disease. At the clinic, we were able to find only 1 case of this condition which was definitely proved; this case we are reporting together with 3 cases which are very doubtful, and which apparently are not tuberculous.

Babés in 1883 definitely demonstrated that the tubercle bacillus was the etiologic agent in this condition. He found and demonstrated Koch's bacillus in the vaginal secretions obtained from a patient who had this disease. Beyea found that in 63 per cent of the cases reported in the literature, the patients were between twenty and forty years of age. In the 108 cases which we have been able to study in the literature (Table I), this percentage was further increased to 73.5. In this series, 10 cases (9.25 per cent) were undoubtedly of primary origin, while 5 additional cases (4.63 per cent) were of doubtful primary character. Beyea found 2 (2.94 per cent) cases of proved primary type and nine (13.4 per cent) of doubtful primary origin in a group of 68 cases recorded in the literature up to 1901. In 1919 Moore estimated that the literature contained reports of 170 cases of tuberculosis of the cervix, of which 20 (11.7 per cent) were of primary type. Harris, however, believed that there were actually fewer cases which were really primary. Bishop said that less than 25 proved cases of primary tuberculosis of the cervix had been reported.

Tuberculosis of the cervix is, in at least 85 per cent of cases, secondary to tuberculosis elsewhere in the body, as in the fallopian tubes, urinary tract, gastrointestinal tract or in the lungs. In the 108 cases which we have studied, 78 per cent had accompanying tuberculosis elsewhere in the generative tract, while 82 per cent of the secondary cases had demonstrable pulmonary tuberculosis, either in a quiescent or active state. Many of these patients gave a family history that was positive for phthisis. Pregnancy and marriage are two prominent contributing factors in the onset of the disease. Bishop said that Jung, Bennecke, and Hashimoto had demonstrated in experimental animals that it is possible to infect the cervix uteri first, and subsequently the fallopian tubes with tuberculosis, or vice versa, and yet have the endometrium remain free of the infection. This fact has been frequently reported in the literature. The order of frequency of tuberculous infection in the female generative tract, from the most common to the least common, is as follows: fallopian tubes, endometrium of the uterus, cervix uteri, vagina and vulva. Thus, secondary tuberculous infection of the cervix usually indicates that it was derived from a descending infection originating from foci higher in the pelvis.

The criteria for primary tuberculosis of the cervix demand that it be the only tuberculous infection in the body. Hence, as Murphy has demonstrated, it must usually be an ascending infection, which has been derived from the vagina or vulva, or more commonly from a tuberculous

TABLE I. RÉSUMÉ OF CASES REPORTED IN THE LITERATURE

YEAR	AUTHOR	NUMBER OF CASES, GENITAL TUBERCULOSIS	SOURCE OF MATERIAL	TUBERCULOSIS OF CERVIX	
				NUMBER OF CASES	PER CENT
1834	Boivin and Dugés	?	Necropsy	2	?
1842	Lisfranc	?	Necropsy	1	?
1853	Virchow	?	Necropsy	2 (1 Primary)	?
	Weigert	?	Necropsy	2 (1 Primary)	?
	Friedländer	?	Necropsy	1 (1 Primary)	?
1872	Lebert	33	Clinical	0	0.0
1881	Lukasiewicz	?	Clinical	1	?
1881	Mayor	?	Clinical	1	?
1885	Spaeth	119	Clinical	6 (1 Primary)	5.0
1887	Derville	?	Clinical	1	?
1887	Winters	?	Clinical	1	?
1888	Cornil	?	Clinical	1	?
1888	Zweigbaum	?	Necropsy	1 (Primary)	?
1889	Thiercelin	?	Clinical	1	?
1891	Schmorl	?	Necropsy	2	?
1892	Williams	?	Clinical	2	?
1894	Emanuel	?	Clinical	1	?
1894	Meyer	?	Clinical	1	?
1897	Kauffman	?	Necropsy	1 (Primary)	?
1899	Vassmer	6	Clinical	2	33.0
1900	Ajello	?	Clinical	1	?
1901	Beyea	?	Clinical	1	?
1902	Horrocks	?	Clinical	1	?
1902	Levers	?	Clinical	1	?
1902	Croft	?	Clinical	1	?
1903	Berkeley	62 (7.7 %)	Necropsy (798)	4	6.4
1903	Brook	?	Clinical	1 (Primary)	?
1904	Murphy	?	Literature, not above	9 (2 Primary)	?
1908	Vineberg	?	Clinical	1	?
1911	Kroemer	267	Clinical	11	4.1
1911	Schlimpert	73	Clinical	3	4.1
1911	Neu	82	Clinical	3	3.7
1911	Horizontow	?	Clinical	?	14.0
1912	Labhardt	73	Clinical	0	0.0
1916	Cullen	?	Clinical	1	?
1919	Moore	?	Clinical	1	?
1920	Greenberg	200	Clinical	9 (2 Primary)	4.5
1921	Norris	66	Clinical	1	1.5
1922	Spalding	?	Operative specimens (6,005)	1	0.016
1923	Neuwirth	?	Clinical	1	?
1924	Culbertson	?	Clinical	1 (? Primary)	?
1926	Pavlovsky	?	Clinical	1	?
1928	Gupta	?	Clinical	5 (?3 Primary)	?
1929	Douglas and Ridlon	?	Clinical	2	?
1929	White	?	Clinical	1	?
1930	Bishop	?	Clinical	1	?
1930	Harris	?	Clinical	1 (? Primary)	?
1931	Bonnet and Builliard	?	Clinical	5	?
1932	Davis	?	Operative specimens (1,200 cervices)	1	0.083

TABLE I—CONT'D

YEAR	AUTHOR	NUMBER OF CASES, GENITAL TUBERCULOSIS	SOURCE OF MATERIAL	TUBERCULOSIS OF CERVIX	
				NUMBER OF CASES	PER CENT
1934	Watson	?	Clinical	1	?
	(Norris)	?	Operative specimens (15,130)	4	0.0066
	(Dannreuther)	?	Clinical	3	?
	(H. Vineberg)	?	Clinical	1	?
1934	Counseller and Collins	?		1*	0.0
				109 (11 true primary and 5 questionable primary)	

*This does not include three doubtful cases which were not proved.

partner at coitus. He said that Klebs and Scanzoni absolutely denied the possibility of the occurrence of such an infection. It is a well-known fact that wives of tuberculous husbands seldom develop a primary tuberculosis of the cervix, while there are cases upon record in which this factor was the cause of a tuberculous salpingitis or tuberculous endometritis with a normal cervix. This fact was demonstrated by Cohnheim in 1879, and by Verneuil four years later.

The importance of tuberculosis of the cervix rests primarily in those cases in which little or no evidence of tuberculosis is evident elsewhere in the body. The physician first discovers the condition when he examines the cervix. The ease with which this disease may simulate carcinoma of the cervix is well known and here rests the importance of its differentiation. With an ulcerated lesion of the cervix, which grossly resembles carcinoma, the examiner would be correct 98 times out of 100 if he diagnosed the lesion as carcinoma. However, the prognosis, treatment, morbidity, and the effect upon the patient are so vastly different in the two conditions that they should be distinguished (Table II).

The four chief types of tuberculosis of the cervix uteri, named in the order of their frequency, are: ulcerative, papillary, miliary, and bacillary catarrhal. Thus, the gross picture of the cervical lesion may vary. It is usually ulcerated; the edges are either well defined or undermined, and are surrounded by either normal tissue or by tubercles. The neighboring portions of the vagina may be involved and tubercles may form. Bishop said that the earliest lesion is a polypoid process and that this is soon followed by ulceration, which may develop into a huge ulcer with ragged undermined edges. On the other hand, the tuberculous infection may be rather deep in the substance of the cervix and reveal little or no ulceration or papillomatous formation on the surface. A rare fibrosing type is occasionally seen. Secondary infection commonly is superimposed on these lesions and more or less cervical bleeding or even hemorrhages are frequently encountered.

Microscopically, typical formation of tubercles is not commonly seen. Often, atypical collections of epithelioid and lymphocytic cells, without giant cells, are the only criteria upon which the microscopic diagnosis can be made. Staining the tissue or smears from the tissue with acid-fast stains often will fail to reveal typical tubercle bacilli. Here, inoculation of guinea pigs is of great value in establishing the correct diagnosis.

TABLE II. DIFFERENTIAL DIAGNOSIS OF TUBERCULOSIS AND CARCINOMA OF THE CERVIX

CERVIX	TUBERCULOSIS	CARCINOMA
Color	Papillary type: rose red, deeper red than surroundings Ulcerated type: crater yellowish or red	Grayish
Appearance	Papillomatous or ulcerated. May be entirely interstitial. Small tubercles may be seen surrounding lesion. Usually many granulations	Fungous, rarely granulations, never entirely interstitial
Size	Smaller	Larger, but no regularity
Palpation	Ulcerated type: ragged undermined edges of the ulcer without diffuse infiltration. Edges often granular Papillomatous type: smooth surface, elastic, knobbed, glistening, no clearly defined limits	Roughened surface of usually stonelike character. Large fungous lesions have very hard base
Bleeding	Usually slight	Common, large amounts often
Discharge	Ulcerated type: greenish yellow, foul, purulent, slightly bloody Papillomatous type: mucoid in character, rarely bloody	Abundant, very fetid, watery, often bloody
Sensitiveness	Present	Usually absent
Pain	Slight or absent	Usually present and characteristic
Course	Papillomatous type: slow ulcerated type: also slow, but may produce fistulas or extensive ulceration	Faster, progressive, diagnostic symptoms
Histology	Characteristic tubercle formation with or without giant cells	Typical squamous-cell epithelioma with pearl formation
Age of onset	Twenty to forty years	Thirty-five to fifty years
Bacteria present	Tubercle bacillus, positive guinea pig test	Secondary invaders. No tubercle bacilli
Gram's iodine test	Negative	Positive

The only positive method of arriving at a diagnosis is to perform a biopsy and have a competent pathologist examine a specimen of the suspicious area of the cervix. The specimen of tissue must be of sufficient size to allow the pathologist to make a diagnosis. This section should include all constituents of the cervix. The biopsy will in no way injure the patient; the issues at stake are of such gravity as to make a correct diagnosis imperative. The earlier literature upon this subject is full of reports of cases in which biopsy was not used, and in which radical surgical procedures were performed for the eradication of a supposed carcinoma of the cervix, with the higher operative mortality and

morbidity, not to mention the anxiety that the false diagnosis of cervical carcinoma caused the patient and her relatives.

The differential diagnosis must distinguish this disease from hypertrophy with eversion and erosion of the cervix, myomatous or polypoid changes, actinomycosis, syphilis, gonorrhea, sarcoma, and carcinoma. Biopsy will be of great aid in the differential diagnosis if it is considered together with the history, physical examination, and laboratory findings.

The treatment of this disease should be surgical whenever possible, and should be of a radical type if the condition of the patient will permit and if other factors are favorable. The contraindications for surgical treatment are advanced local tuberculous lesions, with involvement of neighboring structures, such as the rectum or bladder; tuberculous salpingitis; active tuberculosis elsewhere in the body; marked secondary infection; senility, and cardiovascular disease. The prognosis depends upon the type of treatment instituted, whether or not other tuberculous foci are present, and the state of their activity.

Beyea in 1901 reviewed the reports of 68 cases of tuberculosis of the portio vaginalis and cervix uteri, and added a case of his own. He demonstrated that radical surgical treatment gave the best prospect for a permanent cure. Fifteen of these patients were treated surgically. Seven of the 10 patients who were treated by panhysterectomy recovered completely. One patient who was treated by curettement, amputation of the cervix, and bilateral salpingo-oophorectomy was apparently free from tuberculosis sixteen months after operation. Eleven patients were treated conservatively with local applications (cauterization). One of the latter patients is said to have recovered; 3 were improved temporarily, and in the other 5 cases, the disease progressed. Brook, Moore, Spalding, Harris, Bishop and Murphy expressed the opinion that radical surgical treatment is the only safe means of giving the patient the greatest chance for a permanent cure and recommended either abdominal panhysterectomy or, in certain selected cases, a vaginal hysterectomy. Neu said that the use of dilatation and curettage was exceedingly dangerous in this disease because of the possibility of spreading the tuberculous process into a noninfected endometrium. In his experience cauterization was of little value. In the Berlin Medical Clinic, 55 patients were treated by radical surgery and 75 per cent were living and well five years later. Twenty-two other patients were treated by conservative measures and only 52 per cent were still living at the time of his report. Neu thus believed that radical surgical treatment was indicated in view of the poor prognosis offered by other measures. Wharton believed that surgical treatment should not be undertaken until it has been determined whether or not there is coexisting tuberculous salpingitis and endometritis; if these conditions are present, their extent and state of activity should be carefully noted before deciding on operation. Sasaki expressed the opinion that radium has a beneficial influence upon this disease, because it causes a specific rapid degeneration of the tuberculous tissue, and subsequent marked fibrosis develops. Davis said that panhysterectomy, performed either by the abdominal or the vaginal route, is the treatment of choice if the condition of the patient permits. He advised cauterization of the cervix before an abdominal panhysterectomy is performed. In his opinion, amputation of the cervix is a very questionable procedure; however, a few cures have been reported in the literature, by the employment of this procedure.

The following is a brief résumé of the salient features of the case that we wish to report:

REPORT OF A CASE

A nun, aged twenty-two years, registered at the clinic on June 25, 1934. The family history did not reveal carcinoma, tuberculosis, diabetes mellitus. Her father and mother, together with three brothers and four sisters, were all living and well. At the age of six years she had had an attack of sciatica. Three years before coming to the clinic, the patient had had an attack of pleurisy, which was of short duration.

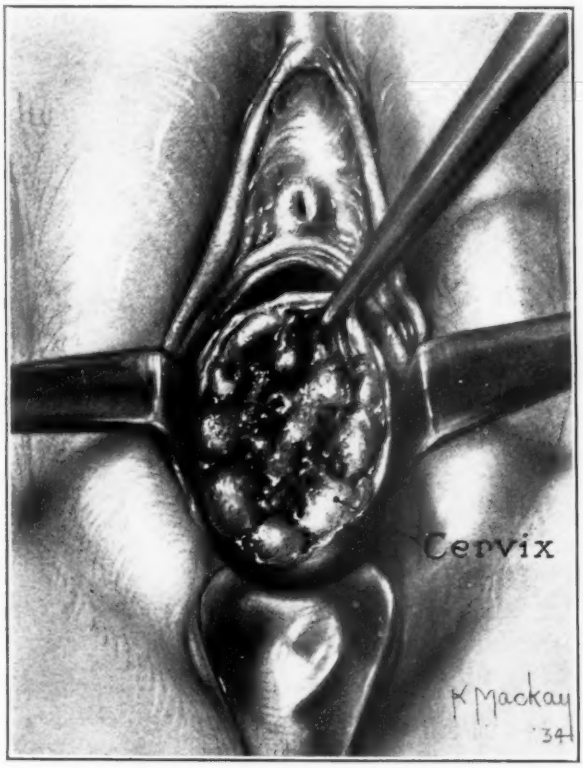

Fig. 1.—Tuberculosis of cervix.

An appendectomy had been performed elsewhere in 1921 for chronic appendicitis. Menses had begun at the age of fourteen years and periods had occurred irregularly, from two to twelve weeks apart. The duration of the period had varied from five to seven days. Leucorrhea was present and was graded 3 upon a basis of 4. However, the menstrual periods had become "normal" during the past six months. The last menstrual period had occurred on May 23, 1934.

The present illness had appeared gradually three years ago, about six months after the appendectomy. This had been characterized by a sharp or a dull intermittent pain, which had been localized in the left lower quadrant of the abdomen. This had been made worse by a sudden motion and by menstruation. It had also been accompanied by a profuse foul, greenish yellow leucorrhea which required the constant wearing of a protecting sanitary napkin. She had been told elsewhere

that a tumor or an enlarged ovarian mass could be palpated in the lower part of the abdomen, for which surgical treatment had been urged. Aside from an occasional headache, the past history was otherwise normal.

Physical examination revealed that her height was 5 feet and 2 inches. She weighed 111 pounds; her average weight had been 112 pounds. Oral temperature was 99.6° F. The pulse rate was 90 per minute; the rhythm of the pulse was regular and the volume was good. Systolic blood pressure was 120 mm. and the diastolic was 80 mm. of mercury, respectively. Aside from moderately enlarged and chronically infected tonsils, the general physical examination was normal and revealed no abnormalities. Examination of the vagina and cervix with a speculum disclosed a marked hyperplasia of the cervical mucous membrane; this was firm and had a cauliflower-like appearance (Fig. 1). One portion of the lesion appeared to transverse the cervical canal and to present at the external os. There were several grayish plaques in this lesion. Biopsy was advised for diagnosis.

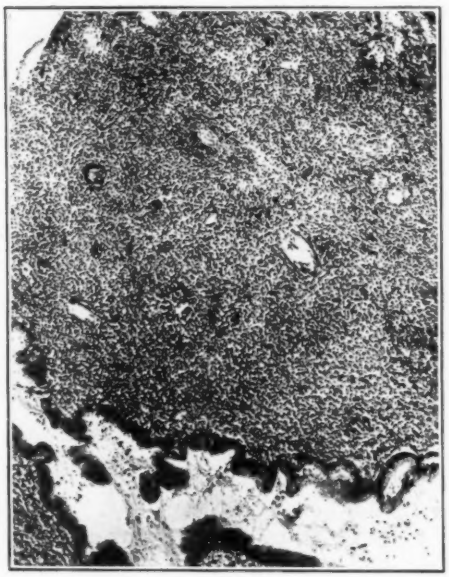

Fig. 2.

Fig. 3.

Fig. 2.—Tuberculosis of cervix uteri, showing typical giant cell and large collections of epithelioid and small lymphocytic cells (×65).

Fig. 3.—Typical tubercle formation in cervix uteri (×120).

The laboratory studies were as follows: The voided specimen of urine revealed an occasional erythrocyte and numerous leucocytes, which were graded 3 on the basis of 4. The value for the hemoglobin was 15.2 gm. per 100 c.c. of blood. There were 5,600 leucocytes per cubic millimeter of blood. The flocculation test was negative. Roentgenologic examination of the chest did not disclose anything abnormal.

On June 28, 1934 a biopsy of the cervix was done and the pelvis was examined while the patient was under anesthesia. The pelvic examination revealed the presence of a normal sized uterus and normal adnexa. Examination of the specimen, which was removed, revealed the presence of tuberculosis (Figs. 2 and 3). The lesion covered the entire external os and extended up the cervical canal. It was accompanied by a marked secondary infection, and it was believed advisable to cauterize the cervix thoroughly, and to observe whether or not the lesion healed as a result

of this treatment. If this failed to eradicate the disease, we intended to perform a total abdominal hysterectomy at a later date.

The postoperative convalescence was uneventful. On July 26, 1934 the patient was again examined under anesthesia. Examination of specimens, which were removed for biospy at this time, revealed only inflamed granulation tissue and did not disclose any sign of the presence of tuberculosis. The pelvic examination also failed to reveal anything abnormal. The cauterized area had healed completely and the patient was dismissed from the hospital and went directly to her home fifty-three days after the extensive cauterization. During the last month of her stay in the hospital, she received sixteen applications of diathermy to the left lower quadrant of the abdomen to relieve a persistent dull pain in that area. The patient was advised to continue sanatorium regimen at home and to return to the clinic within four months for another examination of the cervix. A recent letter from her stated that her health had been greatly improved and that she had returned to her profession of teaching.

This is an undoubted example of the secondary type of tuberculosis of the cervix and probably originated from an attack of active pulmonary tuberculosis which manifested its presence by an attack of pleurisy three years ago.

SUMMARY

Tuberculosis of the cervix is very uncommon. Most cases are secondary infections, which are derived from primary foci elsewhere in the body. The literature on this subject has been partially reviewed. There are probably 300 cases which have been reported in the literature; of these, not more than 35 are primary tuberculous infections of the cervix. Biopsy is the only accurate method of diagnosing this lesion and of distinguishing it from cervical inflammations and carcinomas. Proper treatment appears usually to demand radical surgical procedures so as to insure the highest percentage of permanent cures. The only proved case of this disease which we have been able to find in our records is briefly reported.

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After discussing x-ray in the male genitourinary system, the author turns to a consideration of the female genital organs. In regard to carcinoma of the cervix, he feels that radiation therapy should not be done in any case where operation may be performed and that in those cases in which operation is contraindicated, the proper procedure is *first* to thoroughly irradiate the pelvis with x-ray, following this, six weeks to two months later, with radium. He feels that there are less recurrences with this form of treatment than when radium is first used. Carcinoma of the corpus is treated by operation if possible and if not by split doses of x-ray only. The same is said of ovarian malignancies. Menorrhagias due to nonmalignant conditions, and cases in which sterilization is desirable are discussed. Sterilization dose is considered to be 35 per cent of the skin erythema dose and the author uses 40 per cent, given either in one massive dose or divided into three or four small doses given at monthly intervals. Since small doses may stimulate ovarian function, one-tenth erythema dose is given in cases of sterility and amenorrhea and benefit obtained in about 25 per cent of cases. No deleterious effects have been found from this treatment. X-ray is also used in pruritus vulvae and leucoplakia, and the author feels that carcinoma of the vulva is best treated with combined x-ray and radium.

F. L. Adair and W. G. Birch.

THE METABOLISM OF LEVULOSE*

VII. The Influence of the Reproductive Cycle on Tolerance

Allan Winter Rowe, Ph.D., Mary A. McManus, A.B.,
and Gertrude A. Riley, A.B., Boston, Mass.
(From the Evans Memorial, Massachusetts Memorial Hospitals)

IN PREVIOUS communications, certain general considerations bearing on the metabolism of levulose,[21] and the influences severally of hepatic dysfunction[22] and of the various levels of ovarian function[23] have been discussed. The present paper reports results obtained from the study of women during various phases of the reproductive cycle. The levulose investigations parallel in content and supplement an extended series in which pure galactose was used as the test sugar. These earlier data offer standards of usual performance with galactose in the several phases of reproduction,[17] and in the present group, galactose tolerances were measured as offering criteria for the functional normality of the carbohydrate metabolism in the subjects of the study. In addition to this simple procedure, each patient in the several groups was hospitalized and a comprehensive clinical and laboratory procedure, the "Long Form study," fully described elsewhere,[19] carried out in detail. By this approach, the normality of the individual subject became a matter of factual demonstration and not of opinion, a precaution the necessity of which has not always been recognized.

In determining the tolerance levels, the Hofmeister[8] technic of graded test meals to fasting subjects and examination of the urine for evidences of an exceeded assimilation limit has been adopted for reasons discussed at length in the earlier papers. The administration of the test meals in graded doses varying by 25 gm. has already been described.[21] The Benedict qualitative and Selivanov procedures have been used for the qualitative detection of the test sugar, while the combination of several technics involving the Benedict quantitative, Folin-Wu after clarifying with Lloyd's reagent, the precision polariscope, and the use of controlled fermentations with washed yeast have been applied to the quantitative estimation of the extent of the levulosuria. The full details of the several analytical procedures will be presented in a later communication. The basic data of the several component groups of the series are given in tabular form (Table I).

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A brief description of each group is apposite. The antepartum section of the normal pregnant women were chiefly primiparas drawn largely from a home for unmarried mothers. An exception was a woman of forty-eight, studied at the end of the second month of her thirteenth uneventful pregnancy. Omitting this case, the ages ran

TABLE I. GROUP COMPOSITION

	SUBGROUP	NO.
I	Pregnant, normal, antepartum	19
	Pregnant, normal, postpartum	12
II	Pregnant, toxic, antepartum	21
	Pregnant, toxic, postpartum	23
III	Abortion, postpartum	12
IV	Breast amputation	4
	Total	91

from fifteen to twenty-three, with an average of twenty years. They were studied from the third to the ninth month of pregnancy, the average being between the sixth and seventh months. A number of these same patients appeared in the postpartum section, supplemented by others not examined before delivery. The examinations of the postpartum series were all carried out within a few weeks of the natural termination of gestation. The average age of the group was twenty-two years.

Group II, the toxic series, was composed of patients admitted to the Robinson Memorial presenting some one of the several toxemias of pregnancy. It was purposed to test them both before and after confinement, but for a variety of reasons this was possible with only a fraction of the group. These were older women, in all but six instances multiparas, and many of them presenting histories of one or more earlier toxic crises. The ages ranged from twenty to forty-four, the average age antepartum being thirty, and in the postpartum section, thirty-two years. The average parity was between four and five in each subgroup, the extremes severally being i and xiii. All stadia of pregnancy were represented from the second to the ninth month; the average was between six and seven months, or that shown by the normal group. All examinations postpartum were made within four weeks of the time of confinement.

The small group examined after abortion comprised both spontaneous and induced terminations of pregnancy. They ranged from para i to para vii, with an average of iii; the ages fell between twenty and thirty-five, with an average age of twenty-seven years. The duration of pregnancy before termination varied from six weeks (an ectopic pregnancy) to five months, the average here being a little less than three months.

The final group (IV), cases of breast amputation, was composed of four women who had had bilateral mastectomies for causes other than

malignant neoplasm. They were a still older group, as might be anticipated, the average age being forty-three years. The reason for their inclusion will be discussed later.

Spontaneous evidence of disturbed carbohydrate metabolism is offered by glycosuria where physiologic glycuresis is ruled out. The urine sugar data are given in Table II.

TABLE II. GLYCOSURIA

GROUP		POSITIVE (%)
I	Antepartum	58*
	Postpartum	92†
II	Antepartum	16
	Postpartum	50
III	(Postpartum)	50
IV		0

*Earlier studies 18% to 38%[17]
†Earlier studies 82% to 100%[17]

The incidence of glycosuria is definitely higher in the normal antepartum group than in any other series which we have studied. Our own values, in turn, are higher than the usual report[7] as we collected numerous specimens[18] from each patient and thus increased the probability of observing what is usually an irregularly intermittent occurrence. In the present series, the combination of a high carbohydrate intake by individuals with a physiologically lowered tolerance and living a sedentary life has probably produced a magnified glycuretic effect. Certainly, in none of the other data is there evidence of an abnormally low assimilation limit in this group either ante- or postpartum. In any case, the differences are those of degree. In the latter series (p.p.), the present figure is in harmony with the earlier records.

The toxic series, Group II, show a relatively low incidence of glycosuria antepartum, and one definitely so after delivery. These women were all toxic, and their food intake had certainly been low prior to admission. It is generally conceded that several days of liberal carbohydrate feeding should precede a tolerance test if the results are to be reasonably reliable. Soisalo[25] denies the need of this precaution when blood sugar curves are the indices.

The abortion group also shows a low incidence of glycosuria for the postpartum interval, but the brief duration of the pregnancy, in the majority of these cases, had certainly precluded the establishment of the low carbohydrate level that characterizes the later stadia of gestation. The present figure is to be regarded as wholly consistent with the individual existing conditions. The members of Group IV show no glycosuria, a result to be anticipated.

The blood sugar values for the series are collected in Table III.

But few comments need be made. In both Groups I and II the antepartum level is low, a condition characteristic of pregnancy. After delivery, the averages rise to levels both normal in themselves

TABLE III. BLOOD SUGAR

GROUP	SUGAR (MG.)		
	HIGH	LOW	AVERAGE
I Antepartum	108	77	87
Postpartum	—	—	94*
II Antepartum	105	70	85
Postpartum	114	81	92
III (Postpartum)	104	82	93
IV	100	83	95

*Series record incomplete.

and comparing favorably with each other. The figures reported by one of us[18] from repeated studies on a considerable group studied throughout pregnancy and for a number of weeks postpartum are 83 and 94 mg., respectively. It will be noted further that the zone defined by the maximum and minimum values is not a wide one in any of the series, and the single minimum in the toxic group antepartum is the only value that can be regarded as significantly low. High values are conspicuously absent.

Before discussing the results obtained with the several study series, the criteria for normal performance should be considered, both for levulose and for galactose (Table IV).

TABLE IV. NORMAL STANDARDS

GALACTOSE	STADIUM	LEVULOSE*
20 gm.	Prepuberal	75 – 100 gm. (Av. 81 gm.)
20 – 40 gm.	Puberal (1st year)	75 – 100 gm. (Av. 89 gm.)
40 gm.	Adult	100 – 125 gm. (Av. 105 gm.)

*Values are approximate.

With the latter sugar, the prepuberal child responds positively to a dose of 20 gm. and shows a progressive increase to 40 gm., the adult level, during the first year of the catamenia. With the former, as is shown in the table, there is no sharp line of demarcation between the prepuberal and puberal groups, although the average of the latter indicates an increase of modest proportions which is confirmed at a yet higher level in adult years. There is certainly an upward tendency here, but one relatively much less marked than in the case of galactose.

The data for the normal pregnant group are given in Table V.

TABLE V. NORMAL PREGNANCY

LEVULOSE TOLERANCE	PARTUM	
	ANTE-	POST-
High	100 gm.	150 gm.
Low	50 gm.	50 gm.
Average	68 gm.	77 gm.

Antepartum, the high level as observed is the lower value for the normal adult in a state of sexual rest. The majority of the group gave positive tests at absolutely lower levels, and the average is definitely below that of the prepuberal tolerance. After delivery, there is an irregular return toward earlier levels which in individual cases may even exceed the adult high normal. The average is still lower, however, than that of prepuberal years, although the difference is not of proportions significant in so small a series and one with so wide a scatter in the individual results.

Turning to the literature 9 investigators[3-6, 9, 11, 13-15] report a total of 217 individuals tested orally with 100 gm. of levulose of whom 180, or 83 per cent, gave a positive levulosuria. In the individual series, positive findings ranged from 20 per cent to 100 per cent of the test subjects. Van Creveld and Ladenius,[26] using test meals of from 40 to 60 gm., report 38 in a series of 60 as positive (63 per cent), and 9 more (15 per cent) as questionable. On the other hand, Schroeder,[24] using meals of 150 gm., found but 17 in 95 cases (18 per cent) to be positive and only 3 of these were strongly so. In another group of 132 patients "in various states due to pregnancy," he reports 22.7 per cent as giving positive response. This is an early paper (1905), and it seems probable that the chemical procedures may be responsible for the failure of his cases to respond to so massive a dose of sugar. The data from the other sources, particularly those of more recent date, are roughly in accord with our own findings.

Under the general caption of toxic pregnancy are assembled individuals with a rather wide variety of etiologic conditions. The patients studied in our series were certainly toxic, but from the fact that they were available for somewhat protracted investigation, cannot be regarded, in the main at least, as presenting conditions of marked gravity. Their data may be regarded as an extension of those deriving from the normal group, with, however, a superimposed abnormal condition which in itself might well influence the carbohydrate metabolism.

TABLE VI. TOXIC PREGNANCY

LEVULOSE TOLERANCE	PARTUM	
	ANTE-	POST-
High	75 gm.	150 gm.
Low	25 gm.	25 gm.
Average	61 gm.	65 gm.

Antepartum, the limiting values of the positive zone have moved downward one unit (25 gm.), but the average is not greatly inferior to that of the normal series. While many of the toxic patients exhibited a renal element, the blood and urine findings negative any significant loss of renal permeability. Further, the toxic group shows an average tolerance level below that of the normal series, which is

in accord with the blood and urine findings. It seems doubtful if the renal factor could have produced a significant upward shift in the apparent tolerance. After delivery, however, the upward tendency toward normal levels shown by the average is very slight, but the scatter of the individual observations is even greater than with the normal group. With the latter, the depressing agency was the pregnancy, and, with its termination, mechanisms seemingly were at once initiated to restore the carbohydrate metabolism to its normal nonpregnant level. In the toxic group, on the other hand, the pathologic factor was not at once relieved by delivery, and seemingly there remained sequelae from which the organism recovered more slowly. Where the toxemia had not produced permanent organic change, it could reasonably be expected that time would ultimately restore the tolerance to the normal nonpregnant level.

A survey of the galactose values in this series may be expository to the thesis. Depending on the period of the pregnancy, 30 or 20 gm. may be regarded as normal values antepartum. After delivery, there is a transitory further lowering to 10 gm. (mammary saturation?) with a rather prompt return to the 20 gm. level and later ultimate restoration to the normal adult dosage of 40 gm.; the normal values for the test period postpartum would be 10 or 20 gm. Fifteen of the group gave normal antepartum levels, six were depressed to 10 gm., and one showed a high level of 40. The average of the series, 19.5 gm., is slightly low as the group contained several early cases. After delivery, fourteen gave the expected response with 10 gm. and nine more with the yet normal 20 gm. Only two cases exceeded this value, both responding to 30 gm.; the average of 15.2 gm. is slightly, but not significantly, high for a group of tests within a month of delivery.

The group of interrupted pregnancies offers further data of possible significance to the major problem.

The women composing this series had all conceived and had completed, on the average, about three months of the gestational period. There can be but little question that the maternal organism adapts itself gradually to the new series of physiologic functions intrinsic in the primary condition. One of us has shown[20] that there is a relatively abrupt change in the previously normal respiratory metabolism in passing through a zone, the median of which is about twenty-five or twenty-six weeks before delivery. The sugar (galactose) tolerance, as already noted, shows a gradual decline. In our present group, therefore, we have a series of women in whom have been initiated the various mechanisms incident to their pregnancies, but which, in the main, have not continued to the zone in which they are confirmed and dominantly operative. Some of the pregnancies had terminated spontaneously, this fact implying a superimposed morbid agency, while in others the abortion had been induced.

Without exception, these cases were all tested within two weeks of the expulsion of the fetus. The highest value is that of the high normal adult, the lowest, one unit (25 gm.) higher than in normal pregnancy. The average, while significantly below the nonpregnant nor-

TABLE VII. GROUPS III AND IV

LEVULOSE TOLERANCE	ABORTION	BREAST AMPUTATION
High	125 gm.	125 gm.
Low	75 gm.	100 gm.
Average	89 gm.	113 gm.

mal, is equally remote from the normal pregnant figure. In other words, the tolerance for levulose here exhibits the depressing effect of early pregnancy, and warrants the inference that the agencies intrinsic in the physiologic status have been engendered but still fall short of their full and final influence. The results with galactose are conventionally normal to the condition with but a single exception. This woman had a purulent endometritis, and acute infective processes are known to lower the utilization capacity for galactose; the levulose level in this case was at 75 gm.

The mammary glands of the female normally possess a potential mechanism in which galactose is essentially involved. Lactation implies either the synthesis of galactose from circulating blood glucose or its selective withdrawal from the blood stream; further, it conditions the conjugation of the two hexoses to form lactose. That the mammary glands play a definite rôle in the metabolism of galactose has already been discussed[17] and documented. In the present study, a group of four women have been included, all of whom had had both breasts removed for chronic mastitis (malignant neoplasm usually lowers sugar tolerance). The levulose data on this small group are identical with those for normal intact women; all of them, equally, showed a galactose tolerance of 20 gm., a depression of 50 per cent from the adult standard. However levulose may be utilized by the organism, and this is a matter still of some obscurity, it is obvious that it plays no direct rôle in the function of lactation. Equally, the combined data may be adduced to support further the inference of a mammary factor in the metabolism of galactose.

DISCUSSION

While both of these sugars are utilized in the body and their intrinsic energy ultimately made available to the organism by final oxidation to carbon dioxide and water,[1, 2] it must be evident that there are certain significant differences in the several mechanisms of their metabolism. Both possess the basic and fundamental property of forming glycogen; the metabolism intermediate to this final result,

on the other hand, must involve not only chemical differences, as determined by variation in molecular structure, but seemingly also divergent response to various physiologic agencies.

If individual doses be indicated broadly as relatively increased, normal, or diminished, without attempting the precision of an arithmetical expression, a first approximate estimate may be made of the degree of correlation between the several indications of the two sugars. (Table VIII).

TABLE VIII. GALACTOSE AND LEVULOSE CORRELATIONS

GROUP		% AGREEMENT
I	Antepartum	67
	Postpartum	58
II	Antepartum	62
	Postpartum	55
III	(Postpartum)	67
IV		0

Recognizing that the indices are rough since the standards are necessarily flexible, there is yet a general trend of agreement in only two-thirds of the first three groups, coupled with a complete lack in the fourth, which, however, involved a highly specialized mechanism. The toxic and normal pregnant series show a definite agreement in the correlations before and after delivery, while Group III, although the component cases were studied postpartum, has already been found to agree more nearly with nonpregnant standards. Its better agreement, therefore, with the two antepartum series is consistent with the other data.

Pregnancy certainly lowers the utilization capacity of the organism for levulose, as it does for galactose and indeed, by implication, for glucose. This must be due to some general factor common to the sugars as a whole and intrinsic in the fact of pregnancy. That mammary function, operative certainly with galactose, is not the agent, would seem to be indicated by the results from those patients without these glands. Nurnberger[12] has recently postulated the presence of lowered hepatic function in advanced normal pregnancies. His criteria, like the majority of vital function tests, are no more than end-results common to a wide variety of seemingly independent causes. Kriss and Hirschhorn,[10] on the other hand, interpret the lowered carbohydrate metabolism of pregnancy, demonstrated on the basis of glucose tolerance alone, in terms of lowered activity of the Islands of Langerhans. Their comment that the normal state is regained in a few days after parturition is hard to reconcile with a wealth of contradictory observations from reliable sources.

It seems reasonable to say that the explanation of the phenomenon is not as simple as these writers would infer, and that the precise mechanism is yet to be identified.

For whatever causes and in whatever manners, the fact may be recorded that pregnancy lowers significantly, but not uniformly, the utilization capacity for levulose in human beings, and the effect in the majority of individuals is but slowly dissipated after delivery.

Equally, the mammary glands seemingly play no special part in the levulose cycle of utilization.

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80 East Concord Street

RUPTURED INTERSTITIAL PREGNANCY

Mandel Weinstein, M.D., Long Island City, N. Y.

(From the Surgical Service of St. John's Hospital)

INTERSTITIAL pregnancy is one occurring in that portion of the fallopian tube passing through the uterine muscle. Meyer[4] and Wynne[7] state that about ninety-one instances of interstitial pregnancy had been recorded up to 1917. At that time, they themselves reported a series of 304 cases of extrauterine pregnancies observed in the Johns Hopkins' wards and found only two interstitial pregnancies. Rosenthal[5] collected 1,324 cases of tubal pregnancy from the literature and found that only 3 per cent were of the interstitial type. Lequex[2] was able to collect 75 cases up to the year 1911. There is probably a maximum of 200 reported cases that will withstand critical analysis as to the accuracy of diagnosis.

If we are to believe the gonorrheal origin of ectopic pregnancy, the infrequency of the interstitial variety may be explained by the fact that there are fewer mucosal folds in the interstitial area, and therefore a lessened incidence of gonorrheal infection.

The diagnosis of interstitial pregnancy is a difficult one and rarely made. The symptoms before rupture may be identical with those of tubal pregnancy, namely, abdominal pain, nausea, and changes in the menstrual history. Acute hemorrhages due to the extraordinary vascularity of the site of implantation are more frequent with the interstitial than with any other type; in fact, such hemorrhages may be

fatal. Prolonged amenorrhea is more apt to precede rupture than a tubal pregnancy, and there may be an interruption of the normal menses up until the time of perforation.

Interstitial pregnancy may be confused with pregnancy in a rudimentary horn of the uterus, in which the round ligament is also located on the outer side of the sac. However, the diagnosis is nearly always made when the tube ruptures, and signs and symptoms of serious intraabdominal bleeding occur. In many instances even upon the operating table the diagnosis has been questioned. Many cases of so-called spontaneous rupture of the uterus may have been advanced interstitial pregnancies. In fact, one must bear in mind that spontaneous rupture of the uterus during pregnancy is almost an unheard of occurrence.

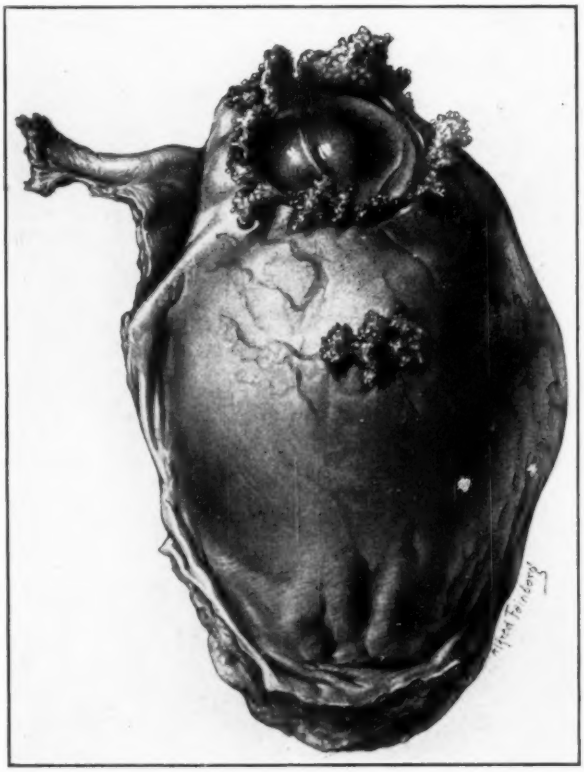

Fig. 1.—Specimen consisting of supracervical portion of uterus and gestation sac. Right tube is attached. Note projection of amniotic sac at superior larger site of rupture, and projection of chorionic villi at the smaller and inferior site of penetration. Also note difference in width of broad ligament stump in side of gestation sac as compared to broad ligament in the left.

The following case report is presented because of the great difficulty in distinguishing this type of advanced interstitial pregnancy from spontaneous rupture of the uterus. This diagnosis was made only following the examination of several specimens from portions of the tissue removed.

Mrs. L. P., aged thirty-eight years, married, housewife, was admitted to St. John's Long Island City Hospital, Oct. 19, 1933, at 3 P.M. with a diagnosis of ruptured ectopic pregnancy. In her history the chief complaint was abdominal pain, weakness, and a feeling of faintness. She had been married eleven and a half years

and never before had been pregnant. Concerning her surgical history, an appendectomy for chronic appendicitis had been performed twenty years previously. Venereal history was denied.

The menstrual history was negative, except that for the past eight years her periods have been irregular at times missing one, two, and three periods.

The last menstrual period occurred during the middle of July. She had noticed her breasts and her abdomen becoming larger. For the past two months patient had felt uncomfortable, tired, depressed, and a "gnawing feeling of hunger." Never experienced any weak spells, or fainting spells. No spotting, and no marked pain in either side of the abdomen.

About two days ago patient noticed pain in her right abdomen for the first time, transient in character. She felt faint, perspired a little. On the day of admission

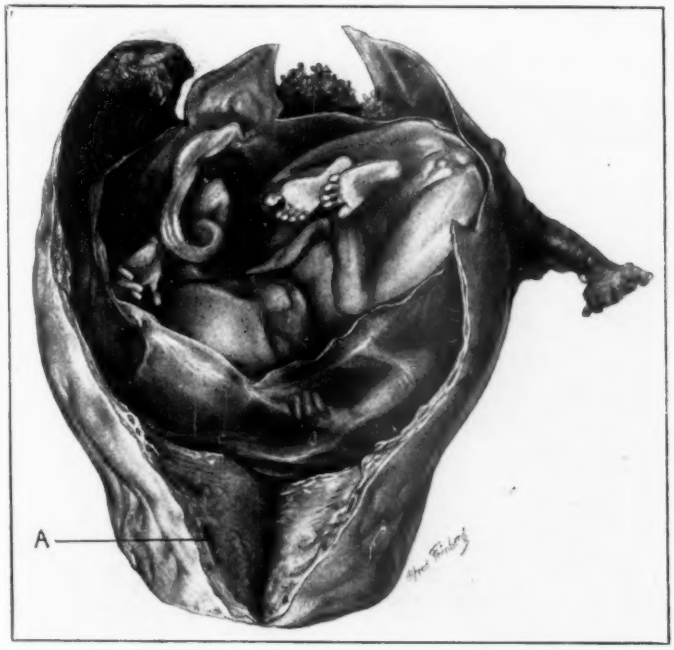

Fig. 2.—Gestation sac and uterus laid open. Note slitlike aperture of endometrial lumen in uterine body, which forms floor of gestation sac (*A*).

to hospital, she was unable to arise from her bed, due to severe abdominal pain and a feeling of faintness. She was getting fainter, perspired profusely, her feet and legs were cold, and eyesight dimmed.

On admission to the hospital her general appearance was that of a patient in profound shock; marked pallor of mucous membranes and cyanotic tinge to skin. Abdomen was distended slightly; a distinct fluid wave was elicited; there was dullness in the flanks; there were indefinite masses involving the whole lower abdomen, the summit of which reached to a point between the pubes and the umbilicus. Patient was cold, restless, pulse barely perceptible.

Diagnosis.—Ruptured ectopic pregnancy with extensive intraabdominal bleeding.

Patient received an intravenous infusion of 5 per cent glucose, followed by a transfusion of whole blood begun through the cannula.

Operation.—Incision: midline from symphysis to umbilicus. Large amount free and clotted blood in peritoneal cavity. Uterine and tubal mass, soft, enlarged to the size of a three to four months' pregnancy. There was a large perforation of

anterior surface of uterine tumor near the summit, through which the fetal sac protruded. A loose irregular placenta presented itself. Around the rim of this opening, there was active bleeding from lacerated veins along the margin of the perfora-

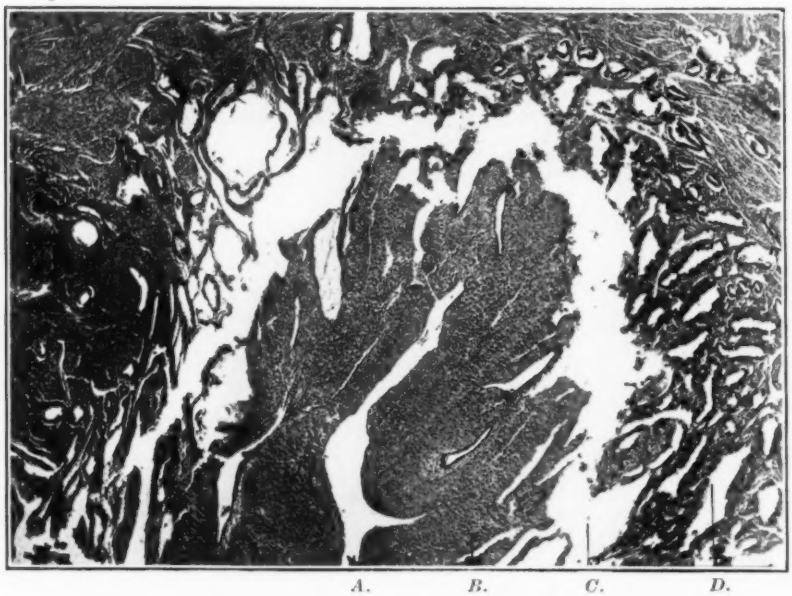

Fig. 3.—Section taken through uterine body; note slitlike lumen. *A*, Decidual reaction of compacta; *B* and *C*, artificial separation from *D* spingiosa in which the characteristic hypertrophic glands of pregnancy are seen.

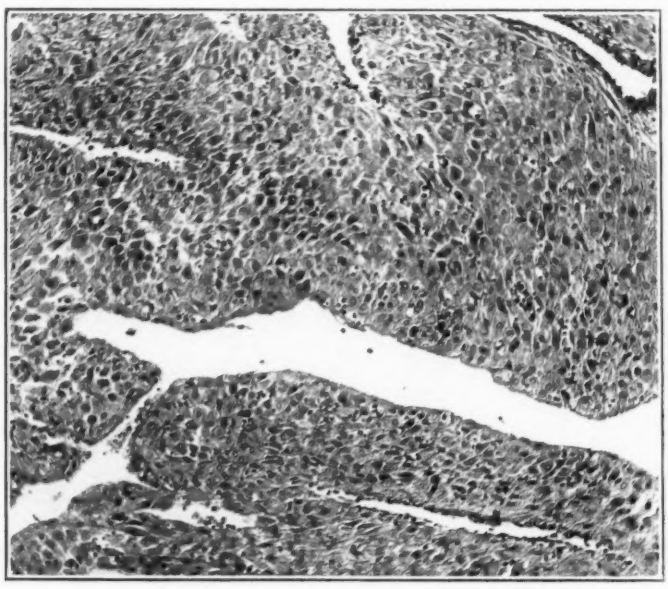

Fig. 4.—High power view of compacta showing characteristic decidual cells.

tion. Placenta projected through anterior uterine wall and several other points. The anterior uterine wall was greatly thinned out and large veins were apparent beneath the serosa.

A rapid supracervical hysterectomy was done, together with the removal of the right tube which was included to save time in the dissection. One suture was used to bring the round ligament pedicles down to the cervix and to approximate bladder to posterior cervical aspect.

Throughout the operation 1,000 c.c. of whole blood were administered intravenously by means of the Hendon cannula.

Anesthesia was gas oxygen with a very small amount of ether added. Total time of operation about thirty minutes.

Pathologic Report.—(Dr. Jacob Werne.) Specimen was a uterus with right tube attached, the major portion of the structure being occupied by sac containing fetus and membranes. The long axis of the structure, 15 cm., formed an angle of about 45 degrees with a perpendicular erected from the supracervical stump, which made up the inferior pole of the specimen. The uterine body itself measured 5 cm. in length.

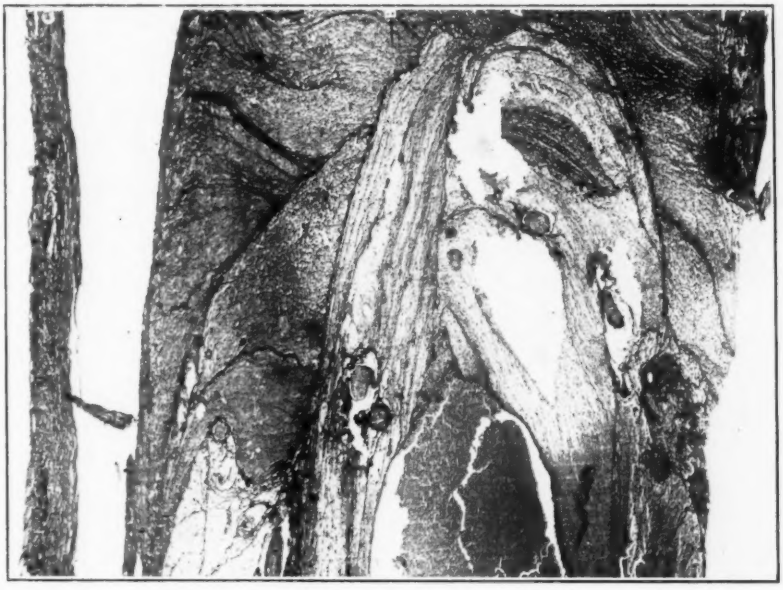

Fig. 5.—Section through gestation sac near site of rupture. *A*, Chorionic villi; *B*, fibrin and blood clot; *C*, attenuated wall of gestation sac. Note absence of decidual reaction.

Projecting from two sites of rupture, ½ and 3½ cm. in length, were fringes of chorion. The placental attachment over the posterior and superior aspect of the interior of the sac, which occupied over two-thirds of the volume of the specimen, had a diameter of 8 cm. Umbilical cord measured 15 cm. The fetus weighed 140 gm. (hardened specimen). Computed age, four and one-half months.

The uterine fundus, which formed the floor of the sac, had a thickness of 2 cm. Endometrium measured from 2 to 3 mm. in the gross; uterine lumen was distinct, slitlike. On the right, the broad ligament measured 10 cm.; on the left, 4 cm. The right tube was natural for a distance of 7 cm. from its patent fimbriated end to the point where its lumen was apparently closed and its wall continuous with the attenuated wall of the sac enclosing the fetus and membranes.

Microscopic Examination.—The compact layer of the decidua which replaced the normal endometrium was made up of characteristic large cells, oval and polygonal with large lightly staining vesicular nuclei. The underlying spongy layer contained

some moderately hyperplastic and dilated uterine glands, some of which extended for varying distances into the subjacent muscle. No chorionic villi were in evidence.

The gestation sac was exceedingly thinned, largely fibrous structure in parts hemorrhagic and necrotic. The attenuated portions showed chorionic villi invading the wall without intervening decidual reaction. Tubal wall (beyond site of gestation sac) was essentially natural.

Patient was returned to bed much improved. Her pulse dropped from 140 to 110, of better quality. Extreme pallor and cyanosis were now gone; mucous membranes were regaining their natural color. Restlessness, and all the previous symptoms of shock from hemorrhage, were rapidly disappearing.

The patient remained in the hospital until November 10. Throughout her stay she was fairly comfortable except for a mild attack of pleurisy in her right lower chest. This subsided readily and the patient was discharged November 10, on the twenty-second postoperative day. She had been seen several times during the months following her discharge from the hospital. Her health had been good, and she had regained the strength she enjoyed prior to her illness. The wound was thoroughly healed and presented a narrow scar. There were no complaints.

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3064 THIRTY-SEVENTH STREET

EMBRYONAL CYSTS OF THE CERVIX AND THEIR ETIOLOGY WITH A REPORT OF TWO CASES*

J. KOTZ, M.D., F.A.C.S., WASHINGTON, D. C.

(From the Department of Gynecology and Obstetrics at George Washington University)

LARGE cysts in the region of the cervix are extremely rare. The usual type of cervical cyst described is the nabothian cyst, which only exceptionally attains any great size. Cysts derived from congenital rests or malformations do not occupy a prominent place in the literature.

My object in presenting these two extremely interesting cases is, therefore, manifold:

1. The condition is unusual and rare. A thorough review of the literature, from 1890 up to the present, reveals, in all, about ten cases.

2. In no previous report is there any mention of what may or may not be an important coincidence, the fact that in both these cases, the condition arose during pregnancy and was primarily noted during labor.

3. The method of diagnosis employed is worthy of additional consideration.

4. The technic of removal is a principle applied for the first time to a cyst of this size, location, and character.

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*Presented at a meeting of the Washington Gynecological Society. November 24, 1934.

CASE 1.—Mrs. M. B., a housewife, aged thirty-two, presented herself at my office on Aug. 22, 1932 for routine prenatal examination and care. Her last menstrual period was March 14, 1932, and the estimated duration of her pregnancy about five months. Her past history was entirely negative, and general physical examination revealed no abnormalities. Pelvic examination showed a moderately relaxed perineum with moderate rectocele and cystocele. No evidence of cervical cyst existed at this time.

The course of pregnancy was uneventful. On Jan. 16, 1933, she went into labor. At about the end of the first stage of labor, I noted a small mass about the size of a walnut protruding from the vagina. This could be traced upward underneath the bladder as far as an examining finger could reach, and was firmly attached to the anterior lip of the cervix. The mass was pinkish, smooth, soft, not tender. Further examination was deferred as labor was not impeded by the presence of this mass.

I examined her six weeks later at my office. At that time the mass had doubled in size, although its general appearance was otherwise unchanged. The anterior

Fig. 1.

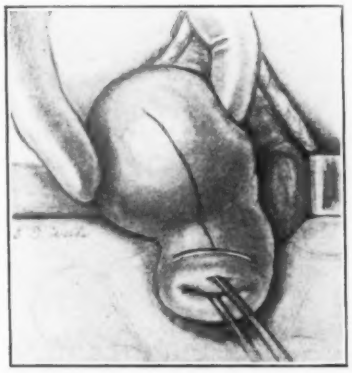

Fig. 2.

Fig. 1.—Posterior view of cyst showing its relationship to anterior lip of cervix.
Fig. 2.—First step of operation: T-shaped incision in vaginal mucosa.

lip of the cervix was about five times as long as the posterior and considerably thickened. Operation was advised but refused. Six weeks later, the patient now noticed the mass would protrude on standing and had grown to about the size of a medium-sized orange. I did not see this patient for about two years. The mass, in the meantime, had grown to proportions that no longer permitted it to prolapse, and the patient had begun to believe herself cured.

On May 25, 1934 she called by phone and told me that during the course of her morning housework, she had felt a sudden gush of fluid from the vagina. The fluid was thick yellow, with a very foul odor, and the amount lost was approximately a cupful. Later, at the office, about a cupful more of the same fluid exuded. Immediate operation was advised and this time accepted.

At the hospital, the patient was first examined under anesthesia. The mass was about the size of a medium-sized orange. It arose from the anterior lip of the cervix near its junction with the vaginal mucosa and extended upward underneath the bladder (Fig. 1). We were unable to determine its exact extent until x-ray study was made. The mass was bluish in color, smooth, soft, painless. A small perforation on the left exuded the same yellow fluid on pressure.

The perforation was closed off with a purse-string suture. The contents of the cyst were then removed with a large needle and syringe, and with the needle in place, lipiodol was injected, refilling the cyst. X-rays were then taken, and revealed the extension of the cyst upward in the general direction of the broad ligament. A metal catheter inserted in the urethra could be palpated at the base of the bladder above the cyst, and proved there was no connection between the two.

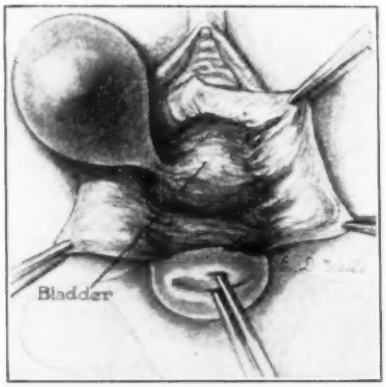

Fig. 3.—Cyst separated by blunt and sharp dissection.

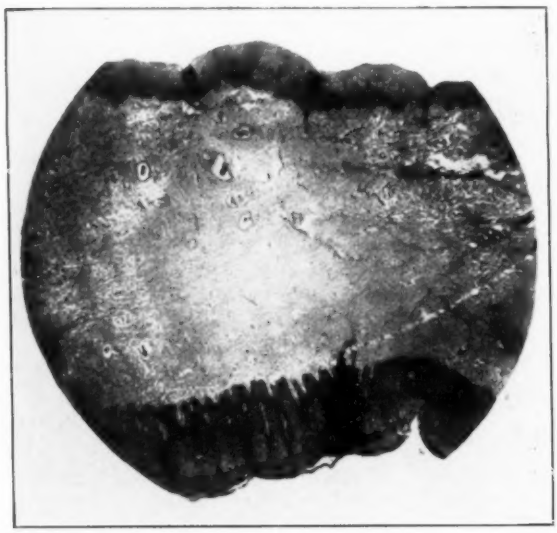

Fig. 4.—Microscopic appearance of cyst wall, showing squamous epithelium resting on intact basement membrane.

The method of removal utilized a principle first described by Auster in March, 1933, for the excision of bartholinian cysts following paraffin injection. The lipiodol was first withdrawn and hot paraffin wax injected to fill up the cyst. This was allowed to harden. An inverted T-shaped incision was then made in the vaginal mucosa similar to that used in the repair of a cystocele (Fig. 2). The mucosa was denuded on both sides by blunt dissection, gradually exposing and delivering the cyst (Fig. 3). The cyst was easily shelled out; the pedicle, which was found rather high up and attached between the layers of the broad ligament, was ligated

and cut. The vaginal mucosa was then brought together with continuous No. 2 chromic catgut suture.

Microscopic examination revealed sections of a cyst wall lined with a smooth hyperplastic layer of squamous epithelium resting on an intact basement membrane. The stroma was infiltrated with lymphocytes and plasma cells. No evidence of malignancy was present (Fig. 4).

The patient made an uneventful recovery and her condition at the present time is good.

CASE 2.—Mrs. C. K., aged thirty, housewife, runs almost a parallel course except that the cyst was removed about two months after its discovery—this operation being performed at the time of delivery. Her recovery was uneventful. Histologically, the picture revealed a cyst lined by simple cuboidal epithelium which in areas had undergone a pressure atrophy. The epithelium rested on an intact basement membrane. The remainder of the cyst wall was smooth muscle and fibrous connective tissue and many thin-walled, dilated blood vessels. No evidence of malignancy or recent inflammatory reaction was seen (Fig. 5).

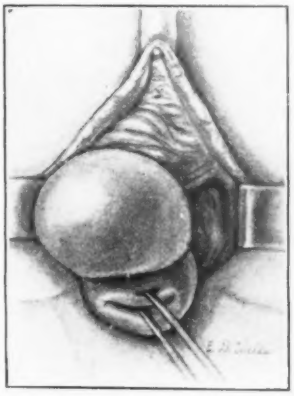

Fig. 5.—Gross-appearance of Gaertner's duct cyst, anterior view, Case 2.

In my opinion, these cysts arose from patent Gaertner's ducts in the anterior cervical wall. Nabothian cysts are generally much smaller and arise by occlusion of a cervical gland duct due to a chronic endocervical inflammatory process, and are the result of a congenital anomaly. A cyst arising from an incomplete fusion of the müllerian ducts is eliminated as a possibility because of the absence of a double vagina and uterus. Again, a cyst formed by the protrusion of a supernumerary ureter into the lateral vaginal wall would show the typical microscopic picture of a ureter.

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1835 EYE STREET, N. W.

INTRAUTERINE GAS GANGRENE WITH RECOVERY

WILLIAM D. CARRELL, M.D., TUCSON, ARIZ.

THIS case is of particular interest because of the recovery with a method of treatment, which violated one of the fundamental rules of the handling of gas gangrene infections in general. The early removal of diseased tissue was purposely neglected due to the site of infection, and was without doubt one of the greatest factors in aiding recovery. The treatment given was quite conservative and could be followed even in the home.

Mrs. B. D., white, female, aged twenty-nine years, admitted to the Southern Methodist Hospital Jan. 27, 1935. A previous diagnosis was made of an active pulmonary tuberculosis in the right apex, and a pregnancy of four months' duration. Two days before admission, she began complaints of severe headaches, blurring of vision and spots before the eyes, nausea, and vomiting. The blood pressure was found to be 240/150, and her eyegrounds showed definite choked discs. At the time of admission she had a slight vaginal discharge of blood. Therapeutic abortion was recommended by the referring physician. No uterine cramps were present.

She had been married ten years, having four children, aged eight, six, four, and two years. Her husband had had pulmonary tuberculosis for several years. In November, 1933, she had an hemoptysis and was in bed four days. About one year ago a diagnosis of pulmonary tuberculosis was made by x-ray plate. In May, June, and July, 1934, she was in St. Mary's Hospital because of her tuberculosis. While a patient there, she induced an abortion with a "slippery elm stick" and was curetted. In November, 1934, she had a pulmonary hemorrhage and was sent to the County Hospital, where she remained until transferred to the Southern Methodist Hospital. She was having no cough or expectoration. Her weight in November, 1934, was 101 pounds and in January, 1935, was 110 pounds. Appetite good, bowels regular, no indigestion. Slow expulsion of urine, no dysuria. For the past two months she had urinated twice daily, but large amount passed each time. Last menses, Aug. 26, 1934.

Examination revealed a moderately undernourished white female. Abdomen negative, except that the fundus of the uterus was halfway between the symphysis pubis and the umbilicus. The cervical canal was patent, and there was a discharge of a small amount of brownish blood having a foul odor. On Jan. 29, 1935, the urine had a specific gravity of 1.024 and contained a large amount of albumin, an enormous number of red blood cells in the uncentrifuged specimen, a few hyaline, and an occasional granular cast.

On Jan. 27, 1935, with aseptic precautions, the vagina was packed tightly around the cervix with wet cotton pledgets. She was given 20 c.c. of 10 per cent magnesium sulphate intravenously and two ounces of magnesium sulphate solution by mouth. Her temperature did not exceed 99° during the next two days. On Jan. 29, 1935, at 9:00 A.M. the vaginal packing was removed. The cervix was found to be soft and slightly dilated. The cervix was further dilated with a Goodell dilator and a piece of gauze was packed very loosely in the cervical canal. At this time she had had no uterine contractions. The blood pressure was 198/124 and the pulse rate 100. She was given a second 10 c.c. of 10 per cent magnesium sulphate solution intravenously. At 8:00 P.M. on this date she had a chill, followed shortly by a second chill. The gauze packing was removed and obstetrical pituitrin two minims hypodermically every thirty minutes was ordered. At 10:00 P.M. the temperature

was 105.6°, the pulse 140 per minute, weak and thready. Digifoline, 2 c.c. hypodermically every three hours, was ordered for four doses. She was having a few uterine cramps at this time. The next morning the temperature was 98.6° and the pulse rate was 106. At 2:00 P.M., Jan. 30, 1935, she was having severe cramps, and I was called to the hospital because the nurse felt that the fetus would soon deliver. Her temperature at this time was 101.6° and the pulse was 126. She was taken to the delivery room and prepared for a vaginal examination. The cervix was plugged with a clot but admitted two fingers, at which time there was expelled from the uterus a large amount of gas with a fetid odor. Smears from the bloody discharge following the gas showed enormous numbers of gram-positive, encapsulated, rodlike bacilli, typical of the Welch bacillus. She was immediately put under quarantine and given intravenously one therapeutic dose of polyvalent gas gangrene antitoxin (Lederle) containing 10,000 units of Perfringeus antitoxin, 10,000 units Vibrion Septique antitoxin, 200 units Oedematiens (Novyi) antitoxin, 200 units Sordellii antitoxin, and 25 units Histolyticus antitoxin. At 6:00 P.M. the fetus delivered spontaneously. It was very badly macerated and could be identified as a fetus only by the skeletal tissue. The soft tissues were full of gas. Moderate manual pressure on the fundus uteri did not expel the placenta. A second dose of the serum was given intravenously at this time. At 2:00 A.M., Jan. 31, 1935, the third dose of serum was given intravenously, and again at this time the placenta could not be expelled by pressure on the fundus. At 10:00 A.M. the placenta could not be expressed. There was less gas from the uterus. The fourth dose of serum was given intravenously. Later, on this day, we obtained from the patient the admission that on two occasions, shortly before she was admitted to the Southern Methodist Hospital, she passed a "slippery elm stick" into the uterus in order to induce an abortion. At 6:00 P.M., the fifth dose of serum was given intravenously, and the placenta could not be expressed. At 8:30 A.M., Feb. 1, 1935, a direct blood transfusion of 400 c.c. was given, followed by the sixth dose of serum intravenously. The placenta was then removed by gently stripping it loose from the uterine wall with two fingers inserted through the vagina while pressure was applied to the fundus through the anterior abdominal wall. The portion of the placenta attached to the fundus was firm and in good condition, but the loose lower portion was filled with gas and was gangrenous. She had a severe chill for twenty minutes, following the transfusion, and the temperature went up to 103.6°, the highest temperature for the preceding twenty-four hours having been 99.4°. The temperature dropped to 98.6° at 4:00 P.M. On February 2 there was no serum available in Tucson. The patient was much improved, ate well, and the highest temperature this day was 100.6°, and the pulse rate was 90 and of good quality. A small amount of gas escaped from the vagina when pressure was applied to the fundus uteri. On February 3 the patient showed further improvement, and no gas could be obtained from the uterus. The seventh dose of serum was given on this day. She continued to run a low-grade fever with a pulse rate of 70 to 80, until discharged on Feb. 10, 1935. On February 6 her blood pressure was 176/126. On this date she was referred back to the medical service. On February 8 a voided specimen of urine had specific gravity 1.020, trace of albumin, a few red blood cells, no casts, and a few pus cells. Cultures of the organism were not made, and the diseased tissue was not sent to the laboratory.

Several plans of treatment were considered. The patient was an extremely poor surgical risk. Hysterectomy would have been hazardous, due to the shock alone, and the added danger of infecting the peritoneal cavity with a following widespread gas infection caused such treatment to be discarded. The cervix was soft and open, and the uterine cramps suggested expulsion of at least the fetus soon after the type of infection was discovered. The fetus was expelled four hours after the diagnosis was made, but the entire placenta was retained and could not be ex-

pressed with moderate pressure over the fundus uteri. At this time she had received two doses of antitoxin, and the temperature was lower, but she was very weak and showed signs of rapid destruction of red blood cells. She was yet not a good surgical risk, and there was no evidence of spread of the infection. It was, therefore, decided to give more antitoxin in an effort to build up her immunity and to remove the placenta at a later date. On the third day after the onset of the symptoms of the infection and following a blood transfusion and the fifth dose of antitoxin, the uterus was manually cleaned, using no instruments in order to avoid spreading the infection further into the uterine walls and the blood stream. The intrauterine infection subsided rapidly thereafter, and with but two more doses of antitoxin she recovered.

It was felt that a gas gangrene infection within the uterine cavity would be less likely to spread than in almost any other space in the body. Treatment was aimed at building up the general resistance to the infection, doing as little as possible to initiate its spread by surgical intervention.

123 South Stone Avenue

THE DETERMINATION OF RUPTURE OF THE MEMBRANES

Arthur G. King, M.D., M.Sc., Cincinnati, Ohio

(From the Department of Obstetrics, Methodist Episcopal Hospital, Brooklyn)

WHETHER or not the fetal membranes have ruptured may at times be a question of great importance to the obstetrician. The history as given by the patient is often untrustworthy. In many cases the amount of fluid lost with the rupture is so slight as to escape detection in the ordinary nursing care. The determination by a vaginal examination is not always easy and this procedure is not considered entirely harmless by all authorities. Hence, some other means of obtaining the information should be a valuable aid in obstetric diagnosis.

When the fetal membranes rupture, the alkaline amniotic fluid reduces the normal vaginal acidity to a neutral or faintly alkaline reaction. The detection of this alteration by an indicator dye would show that the bag of waters was no longer intact.

The use of litmus paper is not satisfactory because of a 35 per cent error due partly to the difficulty in reading the reaction and partly to the pH value at which the litmus color change occurs.

Using colorimetric methods, Temesvary[1] found the following pH values: amniotic fluid, 7.0-7.7; the vagina of pregnant women at term, 5.2-6.0; the vagina of women in labor with ruptured membranes, 6.0-8.1. These figures were confirmed by Bock[2] using the hydrogen ion electrode, the comparable values being: 7.1-7.7; 5.2-6.0; and 6.8-8.2.

Bromthymol blue changes very sharply from orange to blue green at a pH of 6.0-7.6. Temesvary used strips of filter paper soaked in a 0.2 per cent alcoholic solution, which, rolled up in gauze, were introduced into the vagina of 138 women. Clinical findings supported the test readings in 131 cases (73 intact and 58 ruptured membranes). The test failed in only 5 per cent of cases. Temesvary's pupil, Berlind,[3] applied the test in 50 cases, reporting no errors.

This work presents a simple modification of the technic and the results in 314 cases. The indicator dye, dibromthymolsulphonphthalein, commercially known as bromthymol blue, is easily and cheaply obtainable. It is dissolved in either absolute or ordinary 95 per cent ethyl alcohol to make up a solution of 0.2 per cent strength. Well-made cotton applicators are dipped in the solution, allowed to dry, and then sterilized in glass jars by autoclaving.

To perform the test, the labia are separated and the applicator introduced well into the vagina and allowed to remain for a full minute. Urinary contamination need not be feared as the parturient woman's urine is almost invariably slightly acid. On withdrawal, the applicator, although sometimes covered with a little mucus, is easily "read." The original orange color indicates intact membranes; a change to blue green or the appearance of flecks of green anywhere indicates ruptured membranes. If the mucus is considerable, the applicator may be rinsed briefly in running water without affecting the reading. If mercurochrome has previously been instilled in the vagina, the test may still be used although it is a little harder to detect slight changes, and the mercurochrome-stained mucus must be washed off. It is important that the applicator remain in the vagina at least a minute, and occasionally the color change does not occur till several minutes after it is withdrawn.

The accuracy of the test is high. In 141 cases where the membranes were intact the test was negative 140 times (99.3 per cent). The one false positive response was in a bleeding case, and blood, of course, is slightly alkaline. Of 169 cases with ruptured membranes it was positive 160 times (94.7 per cent). The 9 false negatives may be explained by an insufficient amount of amniotic fluid: either all the water had drained off or the head had settled so as to prevent any further flow; as time passed, the natural acidity of the vagina reasserted itself and the test was therefore negative. An analysis of the percentage error in relation to the number of hours since rupture, where this was known, is given in the table. It shows that the accuracy decreases with the passage of time.

PERCENTAGE ERROR IN POSITIVE REACTIONS

HOURS SINCE RUPTURE	0-4 HR.	4-8 HR.	8-12 HR.	12-24 HR.	OVER 24 HR.
Positive readings	96	23	16	11	3
Falsely negative	2	1	1	1	4
Percentage error	2%	4%	6%	8%	57%

To record the accuracy of the test from the point of view of the interpretation of the reading, the following data are available: Of 161 positive readings the membranes were definitely ruptured in 160 (99 per cent). Of 149 negative reports the membranes were ruptured in 9 and intact in 140 cases (94 per cent).

In addition to the false positive test in the presence of free bleeding mentioned above, there were two positive readings that deserve comment. In one case a history of rupture several hours previously was obtained from the nurses' notes, but on a subsequent vaginal examination a thin sac was found. It was the amnion only and it ruptured at the first touch of the finger. The other case was identical except that the time of rupture could not be ascertained although amniotic fluid had been observed trickling. It is known that occasionally the chorion only may rupture with the discharge of a little fluid. In two other cases of the series negative readings were obtained but no history of the rupture of the membranes either before or after was recorded.

SUMMARY

1. The admixture of alkaline amniotic fluid to the normally acid vaginal secretions changes the reaction in the vagina. The resultant pH may be indicated by bromthymol blue which is exceedingly sensitive, and the dye may be used to determine whether or not the membranes are intact.

2. A simple technic is presented which employs sterile applicators dipped in a 0.2 per cent alcoholic solution and the results are easily read: an orange color indicates intact membranes, a bluish green, ruptured membranes.

3. The experiment involved 314 women. The test was accurate in 99 per cent of cases of intact membranes and 95 per cent cases of ruptured membranes. The cause of the single false positive reading and the 9 (6 per cent) incorrect negative readings is suggested.

4. The percentage error with ruptured membranes increases with the elapse of time following rupture: from 2 per cent within four hours through 8 per cent in from twelve to twenty-four hours, to over 50 per cent after twenty-four hours.

5. The test is likely to be positive in the presence of free bleeding and in the rare case where but one of the two enveloping membranes has ruptured.

REFERENCES

(1) *Temesvary, N.:* Zentralbl. f. Gynäk. **57:** 1180, 1933. (2) *Bock, A.:* Arch. f. Gynäk. **155:** 444, 1934. (3) *Berlind, M. M.:* AM. J. OBST. AND GYNEC. **24:** 918, 1932.

3236 BURNET AVENUE

THE PREVENTION OF EXCORIATION OF THE PERINEUM FROM SILVER WIRE SUTURES*

HERMAN GRAD, M.D., F.A.C.S., NEW YORK, N. Y.
(From the Woman's Hospital)

MANY years of use of silver wire sutures in the repair of complete laceration of the perineum has convinced me that in the majority of cases the silver wire suture causes considerable suffering. The pain arises, contrary to expectation, not in the tissues that are sutured together, but is due to an excoriation and ulceration of the skin of the perineum and sometimes the anus, from being in contact with the

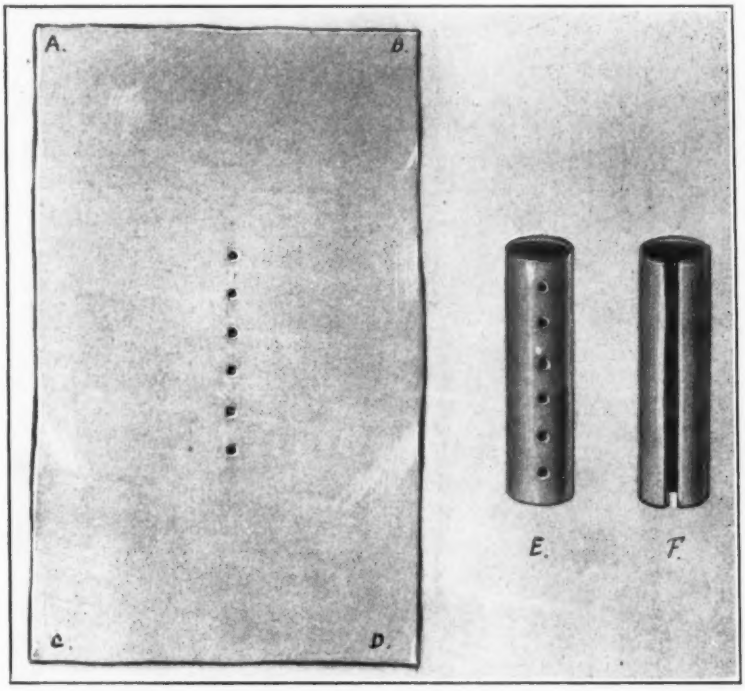

Fig. 1.

ends of the sutures. This discovery led me to devise a means for the elimination of the discomfort.

The procedure suggested has succeeded in eliminating pain in an astonishing manner.

The method consists in preparing two articles. The first is a piece of rubber tissue like that from which surgeons' gloves are made. The piece should be five inches long and three inches wide, as shown in Fig. 1. In the center of this rubber sheet six or seven tiny holes are burned with the point of a pin which has been brought to a red heat by spirit lamp or Bunsen burner. The second article is a piece of rubber tubing

*Presented at a meeting of the Section of Obstetrics and Gynecology, New York Academy of Medicine, April 23, 1935.

one-half inch in diameter and two inches long, capable of maintaining its round shape. On one side of the curve of the rubber tube six or seven tiny holes are

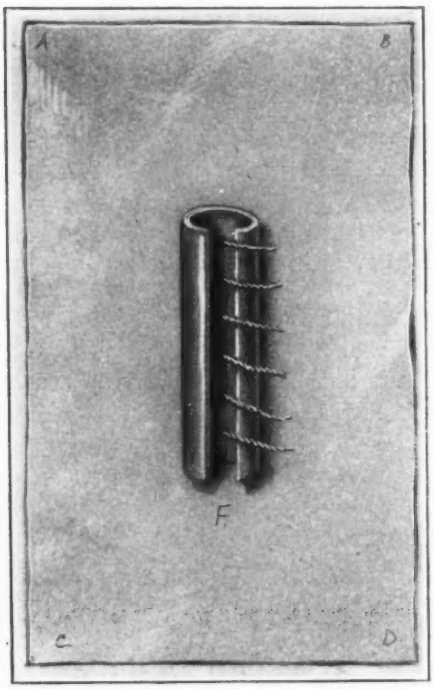

Fig. 2.

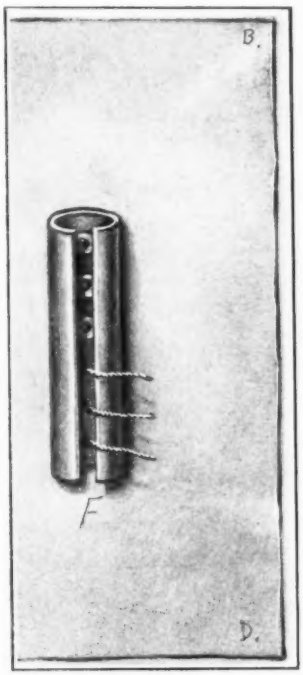

Fig. 3.

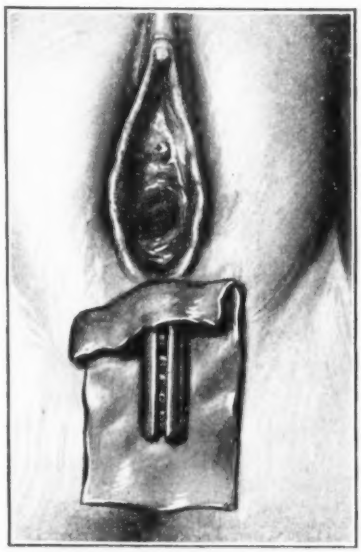

Fig. 4.

burned in a straight line with the hot point of a hat pin (Fig. 1, E). On either side of this tube opposite where the holes were made, the tube is split through its

entire length in a straight line, so that the tube can be opened up and when pressure is released the tube closes up again (Fig. 1, F).

After the ends of the silver wire have been twisted the rubber sheet is spread on the perineum and the ends of the silver wire are pulled through the small opening. The rubber tube is threaded on the silver wire (Fig. 2). The fine rubber sheet A.B.C.D. and rubber tube F. are now in place (Fig. 2). Over each wire is threaded a perforated lead shot, pushed down in the lumen of the tube and made to grasp the wire by flattening the shot. The superfluous portion of the wire is then cut off flush with the perforated shot (Fig. 3). The flattened shot holds the suture firmly and lies entirely within the lumen of the rubber tube. The ends of the suture and shot cannot rub against the patient's skin, as they are entirely hidden in the tube. The rubber sheet which has first been placed on the perineum, is now tied over the rubber tube with a piece of silk (Fig. 4). The last step is for the purpose of protecting the upper and lower ends of the rubber tube from causing excoriation, which will occur if it is not covered with the soft rubber sheet.

225 Central Park West

ANENCEPHALIC MONSTER COMPLICATED BY AN IMPACTED OVARIAN CYST

Louis Rudolph, M.S., M.D., F.A.C.S., Chicago, Ill.
(From the Obstetric Service of the Cook County Hospital)

THIS case is reported in order to emphasize the value of roentgenography in obstetric practice and of laparotomy for a surgical indication during the latter months of pregnancy with a normal or an abnormal fetus that does not call for the removal of the fetus by hysterotomy.

Mrs. B. J., aged eighteen years, white, primipara, married to a Filipino. The family and the personal history were of no importance. The last menstrual period Aug. 15, 1934. At term May 22, 1935. The patient was admitted to the Obstetrical Department of the Cook County Hospital on March 6, on account of a suspected dead fetus. Patient stated that she had not felt life for two weeks previous to admission.

Physical Examination.—A young white female in good general health. She had no abnormal subjective complaints. The uterus was of normal consistency and shape, but upon abdominal examination appeared to be at term. Fetal movements could not be palpated. Fetal heart tones absent. No placental souffle present.

Vaginal Examination.—The vagina was obstructed by a cystic mass which took origin in the posterior vaginal wall and extended into the fornices. The cervix was displaced upward behind the symphysis pubis, and the external os was at the level of the superior border of the symphysis pubis.

Laboratory Examination.—Kahn test negative. W.B.C. 7,650. Urine negative.

Roentgen examination made on March 7 showed an anencephalic monster in a transverse position and high in the abdomen.

Diagnosis.—Anencephalic monster complicated by an ovarian cyst.

Treatment.—Laparotomy for removal of the cyst without interrupting the pregnancy.

On March 15 a laparotomy was performed. The ovarian cyst could not be delivered into the field of operation. The cyst originated from the left ovary. The ovarian pedicle was brought forward as much as possible, which brought the cyst more anteriorly, a trocar was inserted into the cyst, and after the removal of

800 c.c. of a yellow fluid the ovarian cyst was delivered into the field of operation. The usual oophorectomy was performed. The uterus was not disturbed and the abdominal wound was closed in layers.

Diagnosis.—Cystadenoma serosum. The cyst was unilocular and was 13 cm. in diameter.

Postoperative Course.—From the second postoperative day the patient experienced irregular uterine contractions. On the seventh postoperative day these became stronger and in one hour she delivered herself of a macerated anencephalic monster spontaneously. The patient made an uneventful recovery and was discharged from the hospital on the ninth postpartum or the sixteenth postoperative day.

55 East Washington Street

CONTROL OF RESTLESSNESS IN PAINLESS LABOR

R. A. Bartholomew, M.D., and E. D. Colvin, Atlanta, Ga.

A SYMPTOM common to some patients under the effect of an amnesic agent or combination of agents during labor, is a tendency to restlessness during the pains and even between the pains. This symptom, while of no particular consequence during labor, may be quite troublesome during preparations for delivery and actual delivery, due to the difficulties of local cleansing of the patient, keeping the sterile drapings in place and holding the patient in position. This seems to be one of the objections most frequently raised by the physician who has not yet allowed himself to be converted to the use of amnesic agents during labor.

While this symptom has not been present to a troublesome degree in our experience of the past two years, with the use of paraldehyde and sodium amytal or pentobarbital sodium[1] in obtaining painless labor, we have been impressed with the desirability of some method of control of the restlessness manifested by certain patients, particularly just before and during delivery, and have found the following procedures most helpful and free from harm.

During the latter part of the first stage and throughout the second stage, while the patient is in the labor room, moderate restraint of the arms by the use of wrist cuffs fastened to the side of the bed to permit only a limited movement of the arms, to prevent self-contamination of the vulva, and to keep the patient more on her back, has been found to be of great aid. This restraint should not be applied until it is evident that the patient is thoroughly under the effect of the injection.

During the latter part of the second stage, ether, a mask, and a sterile towel are placed conveniently near the bed. Progress is allowed to continue until, in nulliparas the head remains visible between pains and the perineum begins to stretch, and in multiparas the perineum bulges well or the head is visible during pains. Counter pressure with the sterile towel may be used if progress increases too rapidly. Ether is then given with as little disturbance as possible, to the stage of very light primary anesthesia. Pains will be temporarily slowed and the patient thoroughly relaxed. She is then moved to the delivery room and lifted from her bed onto the delivery table.

Meanwhile the nurse has scrubbed and is ready to prepare the patient at once. A small amount of ether is continued and by the time the local preparation is completed, strong pains already have returned or may be stimulated with extract of pituitary. Episiotomy under local anesthesia may permit prompt birth or, if neces-

[1] J. A. M. A. 104: 362, 1935.

sary, the head may be lifted over the perineum with forceps. Spontaneous crowning and delivery is the rule.

The use of ether in this manner, effectively prevents any interference on the part of the patient, with the final preparations for delivery, facilitates control of the patient and does not cause increased bleeding during or after the third stage. The condition of the baby at birth is apparently not affected by this small additional dose of ether.

It is hoped that these suggestions may be helpful to those who have found an orderly obstetric technic handicapped by the restlessness which occasionally complicates amnesia during labor.

1040 Ponce de Leon Avenue, N. E.

Clauberg, C.: Studies on the Infantile and Deficient Human Uterus, Ztschr. f. Gynak. & Geburtsh. **107:** 328, 1934.

Both the infantile and the secondary atrophied (through castration) uteri in the rabbit respond to the injection of follicular hormone. The degree of growth varies in these two groups since the secondary atrophied uterus responds faster to a smaller dose and with greater regularity. It is as if a uterus, once having been under hormonal influences, is in greater readiness to react anew to these stimuli. These observations made on the rabbit were duplicated in the human being. Intrauterine lipoidol-injections, checked by x-ray pictures, measurements of the uterine cavity through the sound, and curettage were employed to register the effect of injections of larger doses (between a 150,000 and 300,000 M.U.) of progynon. One castrated woman received 160,000 M.U. over eight days; another, having been amenorrheic over thirteen years, received 200,000 M.U. over fifteen days. The uterine cavities in both cases increased their capacity enormously, as demonstrated by x-ray. Menstrual-like bleedings occurred six to nine days, respectively, after treatment but three months after termination of treatment the uteri were smaller again. The group of infantile uteri comprises seven patients; all had small uteri, were amenorrheic over long periods of time and had never been pregnant. The dosage used was close to 300,000 M.U. within approximately twenty-one days. Five of the seven flowed from six to ten days after the last injection. Two received over 300,000 M.U., but did not respond with a bleeding. The x-ray pictures of all seven showed an enlarged uterine cavity. Two women with normally developed and functioning uteri were given large doses of progynon; an increase in size of the uterus could be demonstrated.

In these investigations the observation was made that the cervical part of the uterus responds more to the follicular hormone than the body of the uterus. The cervix becomes hyperemic, soft and is more easily dilated. The flow in all cases was in no way different from menstruation. A possible harmful effect of such large doses was considered but could not be demonstrated.

Grover Liese.

Department of Maternal Welfare

Conducted by Fred L. Adair, M.D., Chicago, Ill.

THE AMERICAN COMMITTEE ON MATERNAL WELFARE*

Meeting Held at Atlantic City, June 12, 1935

Chairman's Address

Fred L. Adair, M.D., Chicago

THE American Committee on Maternal Welfare was originally formed as the Joint Committee on Maternal Welfare. The establishment of this committee was the result of a resolution passed in 1919 by the Association for the Study and Prevention of Infant Mortality. This resolution called for the cooperation of the American Gynecological Society and the American Association of Obstetricians, Gynecologists, and Abdominal Surgeons. The Joint Committee was formed by three representatives from each of these organizations. Later a collaborative committee was formed from the American Pediatric Society. Subsequently the Section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association participated in this Joint Committee by appointing three members to represent it. Members of this Committee not only have participated in its work, which has resulted in the publication of certain standards on maternity care, but also have stimulated activity among various medical groups throughout the country by correspondence and the promotion of educational programs among medical organizations. It has also participated actively in an advisory capacity in the work of the Federal Children's Bureau; furthermore, most of the members were active in and spent a large amount of time in developing the work of the White House Conference on Child Health and Protection in 1930.

This Committee has had very meager financial support and has never been in a position to carry on its work in any way except through the volunteer efforts of its members, although small contributions have been received from some of the component societies.

Ultimately it was decided that the committee was of sufficient importance to be incorporated. This was accomplished on April 16, 1934, at which time the name was changed to American Committee on Maternal Welfare. The official purpose of this committee, as stated in its by-laws, is as follows:

"The object for which this corporation is formed is to awaken and stimulate the interest of members of the medical profession in cooperating with public and private agencies for the protection of the health of mothers and their offspring before and during pregnancy and labor, and after confinement, to the end that the conditions which menace and interfere with the health or life of the mother or infant may be improved or prevented, and disease and disorder corrected and prevented, health promoted and life saved; to teach the principles and practices of general and personal hygiene and health to parents; to improve and generalize the standards and methods of training physicians, nurses, and others dealing with problems of maternity; to study and promote the study of the problems involved in achieving the foregoing

*For lack of space it is possible to publish only an abstract of these proceedings; a complete account may be found in reprints obtainable from the Chairman, Dr. F. L. Adair, University of Chicago, Chicago, Ill.

objects; to publish and circulate publications of any kind and description; to receive donations, and to purchase or acquire, receive, take, hold and manage such real and personal property by gift, grant, devise or bequest as may be necessary, useful or desirable for the purposes and objects of the corporation above set forth.''

Since incorporation, various organizations in addition to those previously enumerated have been invited to identify themselves officially with this Committee and to appoint a representative from their organization to represent it at the meeting, including now: The American Association of Obstetricians, Gynecologists, and Abdominal Surgeons; American Child Health Association; American College of Surgeons; American Gynecological Society; Section on Obstetrics and Gynecology of the American Medical Association; American Public Health Association; Central Association of Obstetricians and Gynecologists; Chicago Maternity Center; Children's Bureau, U. S. Department of Labor; Maternity Center Association of New York; Pacific Coast Society of Obstetrics and Gynecology; and the Southern Medical Association.

Since its incorporation the Committee has attempted to stimulate the formation of state committees on maternal welfare and their work is now in active progress. Some states already had committees functioning in this capacity, but most of them had not. One of two plans of procedure has been followed in the formation of these state committees. The first contemplated official action by the State Medical Societies in the formation of such a committee with the thought that each state committee would guide and direct the formation of local committees in each of the county or district societies of its state. This plan was preferred because it was felt that a maternal welfare program would in this way become an official part of the activities of the various state and local medical societies. In the states in which this plan does not appear to be feasible, the national committee has endeavored to secure the active interest of members of the medical profession in leading the activities in their state and in securing the appointment of the necessary local committees throughout that state. The national committee has felt that it should not in any way attempt to dictate the activities of these various committees. It does sincerely believe that such activities on the part of obstetricians and general practitioners are not only advisable but essential for the welfare of both the mother and her infant upon whom the future of the community rests.

Without entering into a discussion of comparative morbidity and mortality in mothers and infants, we are convinced that in most communities the rate for both can be reduced. We are also certain that this can be obtained only by the practice of safe and sane obstetrics during the antepartum, intrapartum, and postpartum phases of obstetric care. Optimum results cannot be accomplished in a day but will be achieved only through the long-continued efforts of those medical men who are sincerely interested in furthering improved maternity care. The practitioners of obstetrics cannot accomplish this unaided, as such efforts must be combined with a corresponding interest and endeavor on the part of the laity and particularly with the cooperation of nursing organizations. The results of cooperative effort among these interested groups would far exceed any results which could be obtained by individual effort. The securing of adequate maternity care, while it requires individual effort with reference to individual patients, must not be regarded any longer as a matter of solely individual concern. It is as much a matter of community interest as any other endeavor directed toward the lowering of morbidity and mortality rates.

Community efforts must be directed toward the development of their own resources for adequate and consecutive maternity and infant care. This implies the utilization of facilities for the proper care of patients in their homes, in offices and clinics, and in hospitals where adequate and special provision is made for the care of mothers and their newborn infants, both premature and mature. Such facilities can be

developed and utilized only by the combined efforts of obstetric practitioners, nurses, and others interested in the development of health activities which pertain to maternity and infant care.

One concrete suggestion which the American Committee on Maternal Welfare has made is that each state and local committee should study its own resources with a view to supplementing and developing them as need arises. It is to be hoped that recognition of the adequacy or inadequacy of these facilities will lead gradually to the development of more complete programs of maternity care for these communities.

Our Committee has already recognized the desirability of setting up certain standards for maternity care during the antepartum, intrapartum and postpartum phases, and, although it has published some of these standards, it is proposed that they be revised and elaborated for the benefit of those who desire to utilize them. Other standards, too, seem to be requisite. A lack of them both in this country and abroad has led to more or less confusion in understanding the results already obtained. Mortality is one of the simplest of problems to study statistically, and yet studies of maternal mortality have been very difficult to evaluate, especially for comparative purposes and from the viewpoint of determining the value of varying procedures. Analysis of data relative to morbidity is even more confusing because there are no generally accepted standards of fetal, infant, or maternal morbidity. Morbidity has, as a rule, been studied merely from the standpoint of incidence of a certain temperature rise, but there has been no general agreement as to what degree of fever should be accepted. Inasmuch as such studies have comparative value only, it seemed wise for the Committee to advocate the adoption of a definition of febrile morbidity. The Committee has, accordingly, defined febrile maternal morbidity to be a fever of 100.4° F. (38° C.) or over on any two of the first ten days postpartum, exclusive of the first twenty-four hours; the temperature should be taken by mouth by the standard technic at least four times daily.

This, however, is only one of a number of standards which should be adopted. If one attempts to define puerperal infection or puerperal septicemia, difficulties immediately arise, because such a condition does not constitute a well-defined entity. Certain states have required the reporting of puerperal septicemia, but their attempt has been more or less of a fiasco and has led to no definite results. So far as the fetus is concerned, there is no clear-cut definition as to what really constitutes a stillbirth and what a living birth. There is no general agreement as to what fetal size, weight, or period of gestation constitutes viability. There is no clear-cut definition of a premature infant, and, so far as fetal and infant morbidity are concerned, there are no definable conditions which can be studied comparatively in different institutions. It is important to recognize other factors of morbidity than fever. Hemorrhage causes morbidity. Trauma is productive of morbidity. And yet we have no definite standards for defining clearly either these or the many other morbid conditions.

Our Committee necessarily is vitally interested in obstetric education, not only of the laity, but also of those groups which concern themselves especially with maternity care. Among these groups may be mentioned social service workers, nurses, in addition to physicians. We should be interested in furthering improved standards of education for these groups. It is not my purpose to discuss education in relation to the activities of these various personnel groups, but it should be emphasized that theoretical knowledge, however good, is not sufficient and that actual experience is essential to the carrying on of the best work in this as well as in other fields of endeavor. So far as medical practice is concerned, and with particular reference to

obstetric practice, only eighteen states and eighteen medical schools of the United States and Canada require an interneship as a prerequisite to the practice of medicine and the granting of an M.D. degree. These are:

MEDICAL SCHOOLS	STATES
University of California	Pennsylvania
College of Medical Evangelists	New Jersey
University of Southern California	Rhode Island
Stanford University	North Dakota
Loyola University	Washington
Northwestern University	Michigan
University of Chicago,	Wyoming
Rush Medical College	West Virginia
University of Chicago,	Oregon
Division of Biological Sciences	Illinois
University of Illinois	Delaware
Louisiana State University	Iowa
Wayne University, formerly Detroit	South Dakota
College of Physicians and Surgeons	Utah
University of Minnesota	Wisconsin
Duke University	District of Columbia
University of Cincinnati	Oklahoma
Marquette University	Vermont
Canada:	
University of Manitoba	
Dalhousie University	
University of Montreal	

Practically none of these schools or states requires that experience in obstetrics be an essential part of the interneship.

It would seem that one very important function of our Committee could be an attempt to secure such requirements and regulations as would make it essential for those engaging in obstetric practice to obtain at least a minimum of training in these fields.

It is important to realize that the families of this country are vitally interested in improved maternity care. The doctors must realize this desire and attempt to satisfy it. It is needless to call your attention to the legislation already enacted and in process of enactment which comes as an answer to this call for better conditions to surround maternity and early infancy. The physicians of this country can and must be in a position, not only to hear this call, but to answer it satisfactorily.

We have attempted to prepare a short program which will give you in brief detail some idea of a few of the activities contemplated in various sections of the United States. The following papers were presented:

"The Cleveland Plan." By A. J. Skeel, M.D., Cleveland, Ohio.

"Organized Maternal Welfare Work in New Jersey." By Arthur W. Bingham, M.D., F.A.C.S., East Orange, N. J.

"Maternal Welfare Work in New York." By J. T. Quigley, M.D., Rochester, N. Y.

"The Plan of Action, Aims and Progress of the Pennsylvania Commission on Maternal Welfare." By James S. Taylor, M.D., Altoona, Pa.

Society Transactions

AMERICAN GYNECOLOGICAL SOCIETY

SIXTIETH ANNUAL MEETING

Hot Springs, Va., May 27, 28, 29, 1935

(Continued from the November issue)

DISCUSSION

1. **Further Studies on the Mechanism of Labor.** Drs. William E. Caldwell, H. C. Moloy, and D. Anthony D'Esopo, New York City. (For original article, see page 763.)

DR. WILLIAM E. STUDDIFORD, NEW YORK CITY.—We have at Bellevue Hospital a precision stereoscope and I consider that this method of study of the pelvis and of the patient in labor has been of enormous assistance to us. A great many cases which have puzzled us, after study with this procedure, have been clarified. The method also has been of marked help in teaching the interne staff and medical students what actually goes on during labor.

DR. F. G. GOLDSBOROUGH, BUFFALO, N. Y.—It seems to me that this work is particularly useful at the present time when the tendency in obstetrics is so much toward operative procedures which are giving rather poor results. Where the greatest number of operative deliveries are being done the maternal mortality is high. The more these cases are studied the better will we be able to predict whether trouble will occur, and to know beforehand whether we shall be able to get a satisfactory result by delivering through the pelvis rather than by cesarean section.

8. **The Place of Colpectomy in the Treatment of Uterine and Vaginal Prolapse.** Dr. Louis E. Phaneuf, Boston, Mass. (By invitation.) (For original paper, see page 544, October issue.)

DISCUSSION

DR. W. T. DANNREUTHER, NEW YORK, N. Y.—Dr. Phaneuf has used the term prolapse in its broadest sense, to include descent through the vagina of any or all of the pelvic structures. From the practical standpoint, it is desirable to subdivide patients with such lesions into three groups: first, those who are candidates for surgical repair for the first time; second, those in whom ineffectual or inadequate attempts at operative correction have already been made; and third, those who suffer from complete inversion of the vagina after abdominal or vaginal hysterectomy.

In the first group, the experienced pelvic surgeon has a wide choice of available technical procedures and will select those which are best adapted to a particular case. His choice will depend upon the patient's age, marital state, the likelihood of future pregnancy, the extent of damage to the vaginal structures, and the coexistence of either uterine or adnexal pathologic conditions. Only in elderly patients and under exceptional circumstances will any form of vaginal closure be justified in this group of patients. I have done a LeFort colpocleisis under local anesthesia in three widows over seventy years of age with great satisfaction. On the other hand, I

made the mistake of doing the same operation in an obese virgin of fifty-six with a complete procidentia, and was soon thereafter confronted with extensive recurrence.

In the second group, the operator will often be compelled to exercise his surgical ingenuity, not only to correct the prolapse, but to undo what has unwisely or improperly been done previously. The Jackson operation has served me in good stead in several such instances. Some patients are compelled to return because of the neglect of an enterocele or posterior vaginal hernia at the time of the original operation. When the uterus is still in situ, and a colpocleisis is performed, the subtotal operation is preferable to a complete colpectomy, because it makes provision for drainage, and even normal mucus can always escape.

The third group is the one in which complete colpectomy is most frequently indicated, and in which colpocleisis, both partial and complete, may most often be utilized without regard for anything other than the cure of the everted vagina. Nearly all of these patients are advanced in years and are not concerned with vaginal patency. Occasionally, however, a relatively young woman will require some other soluton of her problem. In one such instance I opened the abdomen, dissected the bladder free, and reconstructed a firm pelvic support by building a platform under the bladder, consisting of the laterally overlapped broad and round ligament stumps, and the split apex of the vaginal tube. This cured the inversion. In another case I fixed the apex of the elongated vagina to the abdominal wall, but neglected to split the top and denude it of mucosa, as advocated by Crile. This operation eventuated in recurrence, and the patient was subsequently cured by a LeFort operation. Norman F. Miller has suggested opening the anterior vaginal wall, doing a Rawls cystocele operation, and pulling the prolapsed vagina up by "lifting" sutures inserted at the base of the uterosacral ligaments. Miller reports two successful cases.

The great advantages of colpocleisis and colpectomy are the simplicity of technic, the dispatch with which they can be done under local anesthesia, and their freedom from hazards even in poor surgical risks. In doing the LeFort operation, I have found it of advantage to place one Pagenstecher linen suture at each corner of the rectangular denudation. Like Dr. Phaneuf, I have done a vaginal colpocleisis about 25 times without any morbidity or mortality.

DR. FREDERICK C. HOLDEN, NEW YORK CITY.—I am convinced that the LeFort operation has a definite field of usefulness, and have performed this operation 31 times within the past eight years. Prior to 1927 I performed complete colpectomy in two cases, making a total of 33 cases.

In 1929, Baer reported to this Society a series of 220 patients operated upon for prolapse; in 14 of these the LeFort operation was done. In discussing Baer's paper, Gellhorn correctly said that the LeFort operation had fallen into an entirely undeserved oblivion. Very few books describe this operation. In Davis' *System* and in Curtis' *Obstetrics and Gynecology* there is no mention made of it. I had never seen the operation performed until after I did my first case in 1927. I believe the reasons why this very satisfactory operation, which was described in 1877, went into the discard were: first, that at that time the only suture materials available were silver wire and silk; second, the high muscle perineal repair was unknown; third, the cases may not have had adequate preoperative preparation.

I note that Dr. Phaneuf amputated the cervix in five cases. In none of my cases have I had occasion to amputate a cervix. Many had extensive ulceration of the cervix caused by the trauma of being sat on, but in all such cases a period of preoperative treatment completely healed the cervical lesions.

One patient entered the hospital with a complete irreducible prolapse which was reduced only after the patient had been in a very high elevated foot posture with continuous applications of warm wet dressings for forty-eight hours. She required local treatment for about two months, due to the extensive ulceration and brawny induration of the vaginal and cervical lesions, but she made a splendid recovery.

Before that time I had seen three complete irreducible prolapses which remained unreduced despite treatment and all of these patients died of sepsis.

In my series of 31 cases, the age varied from 50 to 77, the average being 62. The anesthetics used were morphine and scopolamine, local or spinal, and gas oxygen.

I had one fatality. The woman, sixty years of age, was referred from the medical service to which she had been admitted with marked ecchymosis of both arms and legs. She was mentally clouded and unable to state exactly why she came to the hospital. She had had very little to eat in the past few months. The discoloration on the extremities cleared up promptly under an antiscorbutic diet. The anesthesia used here was a small dose of novocaine intraspinally. She died on the fifth day postoperative from bronchopneumonia. The results in the other 31 cases were excellent. For cure of the prolapse in those who have passed the age of sex life, even though the general condition may be poor, the LeFort operation can be done with comparative safety, and with uniformly excellent results.

DR. CAREY CULBERTSON, CHICAGO, ILL.—I have performed colpectomies in three women, 63, 69, and 69 years of age, where the extruded vaginas, twelve, fifteen, and twenty years after previous hysterectomies, were so badly diseased as to render any simpler procedure impossible. In these cases ethylene gas or nitrous oxide gas were the anesthetics.

Hysterocolpectomy was carried out in six patients, 62 to 76 years old with the exception of one who was 54. In all of these the entire vagina was taken out because of disease on its own part, the uterus coming out incidentally. Scopolamine-morphine with novocaine infiltration was the anesthetic in all except two, where ether was used.

In five other patients who were younger, extrusion of the vagina had occurred, in two after subtotal abdominal hysterectomies, and in three after total hysterectomies. In all of these it was necessary to preserve the lower genital tract, the patients varying in age from 36 to 49 years. The two who had a cervix were repaired by the old operation of fixation of the stump into the abdominal wall, abdominal trachelopexy. The other three women were treated by what may be called vagino-abdominal ligamentopexy; that is, opening of the vaginal vault and, by abdominal incision, fixing it with such ligamentary structures as could be found or made. These operations were all associated with perineorrhaphies of course, and were technically successful. Ether was the anesthetic in two of these, ethylene gas in two and nitrous oxide in one.

The safest and simplest of these various procedures for elderly women is the operation proposed years ago by Neugebauer and then by LeFort. I have employed this anteroposterior colpocleisis in seventeen patients, all with fortunate results. I prefer to limit the operation to women in the sixties and seventies who will no longer work hard. One of my patients was only fifty-seven years of age, a widow suffering from severe myocarditis, until she was unable to walk upstairs. The LeFort operation was done under scopolamine-morphine anesthesia eight times, with ethylene gas four times, and nitrous oxide three times. In one case ether was used, it being the only anesthetic available. The results have been uniformly good and there has been no recurrence.

In a certain number of cases the cervix does not yield readily to preoperative treatment or is only superficially eroded. In eleven of these seventeen cases I

trimmed it off squarely and rolled it in with the closure. These elderly women do not have a cervical or uterine discharge, in some cases they do not have a cervical canal, and I do not hesitate, for that reason, to amputate the cervix superficially in the denudation.

Dr. Holden has emphasized the point of building in a perineum below. The anterior vaginal wall is nearly always shorter than the posterior, and if the fourchet denudation is flared out laterally and obliquely, then approximation from side to side, after the colpocleisis is effected, constitutes a perineorrhaphy.

DR. GEORGE GELLHORN, ST. LOUIS, MO.—In the elderly women in whom this operation is performed, any general anesthesia is, as a rule, contraindicated. Spinal anesthesia is too dangerous; it is like shooting at little birds with a big cannon. All that is needed here is local anesthesia, and less than two ounces of a one-fourth per cent novocaine solution with adrenalin are sufficient to produce a complete analgesia.

Dr. Dannreuther's failure with this operation cannot be laid at the door of the LeFort technic. I had a very similar case of total prolapse in a girl of fifteen years in whom the condition had existed for seven years. In this instance, as well as probably in Dr. Dannreuther's case, we have to bear in mind a constitutional anomaly which manifests itself in an abnormally deep and wide culdesac. The best method of procedure in such a case is an abdominal operation, complete obliteration of the culdesac by suture, and the production of an incline that leads obliquely down from the promontory to the symphysis so that the small intestines cannot enter and produce what eventually amounts to an enterocele.

DR. GEORGE GRAY WARD, NEW YORK, N. Y.—Two weeks ago I saw a woman in her thirties who had a congenital absence of the vagina. Some one had done a Baldwin operation on her and she has an artificial vagina which is excellent so far as the depth and function are concerned. This patient had developed an abscess of the perineum which resulted in destruction of the sphincter ani, so that there was no perineal body and now when she strains, this artificial vagina comes out and hangs outside the body, like a glove finger. I would like to ask Dr. Phaneuf if he has any suggestions how to handle this case.

MR. VICTOR BONNEY, LONDON, ENGLAND.—I have done LeFort's operation for a great many years on elderly women, and it is admirable in that class of case. I would suggest that instead of suturing the two halves of the vagina directly together so that the line of union has no depth or thickness, it is well to invert the edges so as to get a greatly increased area of adhesion. The septum is much stronger and broader when sutured in this way. I usually employ mattress sutures passed through the flaps so that the loops lie on the vaginal surface. The free ends of the sutures passed through the right-hand anterior flap are tied to the free ends of the sutures passed through the right-hand posterior flap, and similarly with the left-hand flaps. Alternatively two continuous sutures may be used, one on each side, each one passed with its loop on the vaginal surface like Connell's intestinal suture. The interrupted sutures, however, give the strongest result.

DR. FRED L. ADAIR, CHICAGO, ILL.—We have had 35 or 40 partial colpectomies, not any total colpectomies; death occurred in two cases. I do not know how you will avoid a casualty when operating on women at the age at which this is usually done. In patients with diseased cervices we have performed a hysterectomy in connection with the partial colpocleisis. As Holden suggested, we tie the knots inside of the new canal, getting a fairly wide bite of the vaginal tissue in order to unite the walls. We frequently combine a cystocele operation as well as a perineorrhaphy and usually, instead of making a complete rectangular flap, we carry it down grad-

ually under the external meatus so as to tighten up the slack in the lower portion of the urethra. The point is that instead of removing the flaps in toto, we remove the flaps and suture as we proceed in order to minimize the blood loss.

DR. JOSEPH L. BAER, CHICAGO, ILL.—Since 1929 our staff has done 21 additional such operations which were reported last fall before the Central Association in New Orleans. Of the 21 operations, 20 were of the LeFort type, and 1 was a total colpectomy.

In connection with the technic, it is our practice to approximate the raw surfaces by transverse sutures as well as the inversion sutures on each side which close the vagina and make the horseshoe-shaped drainage tract. In other words, we bring the raw surfaces together with very fine catgut as we turn them in layer by layer to insure hemostasis.

DR. PHANEUF (Closing).—Although in Boston ether is the anesthesia of choice, from year to year I have increased the employment of local anesthesia.

9. **Toxemia of Pregnancy,** Dr. James R. Goodall, Montreal, Canada.

(For original article, see page 577, October issue.)

DISCUSSION

DR. WILLIAM J. DIECKMANN, CHICAGO, ILL.—Dr. Goodall's work would seem to indicate that the pathologic changes in the placenta are the cause of the toxemias of pregnancy. While we believe that the placenta is intimately associated with the toxemias, we do not believe that the lesions found in the placenta are the cause of the toxemia. If these pathologic changes in the placenta are the cause of the toxemia, then they should always be present in toxemia. Again, the placenta quite often may show marked pathology and yet the pregnancy has been normal. I would like to ask Dr. Goodall how to reconcile these conditions.

DeSnoo pointed out a number of years ago that many of the toxemias were characterized only by an increase in blood pressure. We have a sufficient number of cases now to make us absolutely certain that many of the cases of toxemia are primarily vascular diseases. We have not been able to decide in the majority of cases whether the patient had a predisposition to vascular disease which was aggravated by the pregnancy or whether the pregnancy per se has been the cause of the hypertension.

Dr. Goodall stated that changes in the blood chemistry are the result and not the cause of the toxemia and are of very little help in the differentiation of those cases which will have permanent vascular renal damage. We cannot agree with these statements in toto. We believe that the chemical changes occur early in the disease and, in fact, are a part of it. We have also been able to make use of these changes as a prognostic guide and in classifying the various types of toxemia.

The essayist stated that more attention should be devoted to the baby. In the toxemias of pregnancy the fetal mortality, both before and after delivery, is appallingly high, and we are becoming more and more pessimistic in our views as to the advisability of carrying toxemic patients for weeks in an endeavor to get a viable baby.

We have noted a marked incidence of abruptio placentae in patients with vascular disease. It may be that the changes in the vessels of the uterine wall, such as Dr. Goodall pointed out a number of years ago, are the cause of the premature separation of the placenta. We have also noted that the placental infarctions which were shown so beautifully are almost always present if there has been a marked albuminuria over a period of several weeks.

DR. FRED L. ADAIR, CHICAGO, ILL.—Some years ago we made extensive studies of the placenta, particularly with reference to Young's ideas in connection with eclampsia, and it seemed to me that we must have three postulates satisfied before we could accept this etiology. The first is that the lesions should be constant, second, that these lesions should not be present in normal placentas, and third, that they should not be present in other pathologic conditions of the mother which are not apparently related to the toxemias. In a series of cases which we studied, which represented a great many observations, we were unable to satisfy any one of these three postulates. We frequently found normal placentas, as far as we could demonstrate at that time, also we found lesions which appeared to be identical in patients who appeared to be normal, and lastly, we found similar or identical lesions in association with other conditions which were not related to the toxemia. We concluded that placental pathology was not the cause of the toxemia but was rather the result of these conditions that were associated with the toxemias.

We also carried on the study of the placenta in another series of cases in which we observed particularly the weight and surface area of the placenta in relation to the size of the child. We noted some of the pathologic changes that occurred in the placenta. One of our conclusions derived from the study was, though not quite so accurate as Dr. Goodall's, that less than half of the placenta is necessary to the survival of the child. Dr. Goodall pictures it more accurately at 25 per cent.

On the basis of our observations and those of others we feel that what has been called placental insufficiency is quite an important factor in the development of the fetus. If the placenta is sufficient up to a certain point, the fetus has a tendency to grow and may outgrow the placenta, and as the outgrowth occurs the child will die in utero. Other children do not die but do not grow to the extent of the normal child with a normal placenta, and we have been induced to name those infants immature. We have observed a number of infants who have the same relative size as the premature infant; they are much more vigorous but have not grown as they should have grown for their period of gestation. These results are related, we believe, to the physiology of the placenta and owing to the improper nutrition from the placenta do not grow, but their central nervous systems and their vital functions do mature and they are more apt to survive than premature infants of similar size, but less mature from the standpoint of gestation.

DR. COLLIN FOULKROD, PHILADELPHIA, PA.—I am sure that Dr. Goodall did not intend to convey the idea that, because of these lesions in the placenta, the cause of the toxemia was either fetal or placental in origin. In the latter half of pregnancy it is believed there exists a form of toxemia entirely related to pregnancy and that toxemia has important protean manifestations in the body and in the placenta. As we look at the diseases of the placenta, Dr. Goodall has shown us specimens containing nephritic changes which follow late in the course of the toxemia. Some of these hemorrhagic conditions are found in true nephritis, therefore there exists before those hemorrhagic conditions occur a condition of toxemia without nephritis, but the nephritis following may lead to hemorrhagic conditions. In the average patient the toxemia which follows nephritis may arise in the early part of the pregnancy. His point is rather well worth considering, that the toxemia is in itself an entity, finally showing itself in the death of the child.

I was surprised yesterday in the discussion of the hypothyroid patients that no mention was made of the fact that those of us who do not live in the goiter belt often see hypothyroidism in pregnancy and that it often leads to a form of toxemia, or is in itself a disturbance of metabolism that leads to the death of the child from perhaps a primary cause.

Hypothyroidism as we study it in our sterility clinics is divided into two classes: first, primary thyroid in origin, and second, the cases which if a careful evaluation of the pituitary is carried out will be found to be primarily pituitary, showing some deficiency of the thyroid, and the pregnant woman must have some of that pituitary impetus throughout the pregnancy to carry her to term. If we fail to furnish that impetus, there will be a dead baby and a disturbed condition in the body which usually in the hypothyroids involves all parts of the body. One might go over all of these protean manifestations and yet come back to the manifestations shown by Dr. Goodall, that there is one origin of these conditions. A study of such placentas must be viewed according to whether these patients were in the latter stages of toxemia or the period showing nephritic changes added to the toxemic changes.

DR. GOODALL (Closing).—It was most remote from my thought to convey the impression that the placental changes were the cause of toxemia. On the contrary, as Dr. Foulkrod has brought out, my contention is that it is the result of the toxemia and not the cause.

Dr. Adair's statement, which must receive consideration of course, is that in so many cases of toxemia we do not find any placental changes. That is just what I would expect. The law of susceptibility, of selectivity, comes in here with the utmost force and the placenta is susceptible more than any other tissue of the body possibly because it has a short life. It is a mushroom growth and most imperfect and it begins to undergo senile change at the seventh month. It is a very rare thing, extremely rare, to find a normal placenta at full term. That very senility predisposes to toxic changes and that is why the placenta, I think, is so frequently the selected point for the manifestation of the deleterious changes of toxemia.

A short time ago I outlined the various clinical types of toxemia depending for their variety upon the systems that are affected. We have the renal type in which the kidney is the one system with its vascular changes which bears the brunt of the attack. In others the kidneys do not seem to be affected at all and we have the vascular changes in which the blood vessels lose that power of discrimination whereby they allow certain things to pass through and certain ones not to pass through. In other cases we have no signs but in the nervous system, certain cataclysmic changes. And there is the other type where the liver seems to be affected chiefly. The selectivity, whatever the cause may be, I outlined in my paper last year in reporting five cases of nephritis "cured" by pregnancy. Now those are not nephritics; those are nephrotics. We cannot assume that their nephritis is cured by pregnancy, nor can we assume that those cases of the renal type are nephritic because the cessation of the pregnancy usually clears up the nephritis or the nephrosis in a few hours or a few days.

What I want to impress is that the placental changes are secondary and because they are not always found is no argument against the connection.

I agree with Dr. Studdiford that the hemorrhages are difficult to explain, but they are primarily thrombotic, due to changes in the blood vessels. I have demonstrated that to my own satisfaction repeatedly.

10. **Prophylaxis in Gynecology with Special Reference to the Immediate Care of the Postpartum Cervix.** Dr. Byron H. Goff, New York, N. Y. (Published in the current volume of Transactions.)

3. **The Treatment of Carcinoma of the Cervix by Wertheim's Operation,** Mr. Victor Bonney, London, England. (By invitation.) (For original article, see page 815.)

DISCUSSION

DR. FREDERICK J. TAUSSIG, ST. LOUIS, MO.—In 1912, at the Baltimore meeting of our Society, I presented, in connection with a symposium, 60 cases done in the Midwest by the Wertheim operation for the treatment of cancer; 23 of those cases were done by me, and I had to acknowledge that my operative mortality in that series was 39 per cent. That was due to the fact that we had no other therapeutic resources; radium was not used at that time and in many cases operation was done in desperation where it should not have been attempted. Since that time, I have done, including those 23 cases, 87 Wertheim operations and the total mortality is 15 per cent. If we exclude this earlier group, and include only those operations done after 1912, my operative mortality has been reduced to 6 per cent. Eliminating also the cases that have been done since 1930 we find 43 cases done between 1912 and 1930 with two operative deaths, 4.6 per cent; and 26 cures for five years or more, 60 per cent. Of this number there were 23 patients who were operated upon over ten years ago, with one operative death and 10 living and well at the present time, 43 per cent ten-year cures.

This figure is due, of course, to the fact that I have as the result of my early experience been limiting the operation to Group I cases and no longer have included the Group II or borderline cases.

I do not agree with Mr. Bonney, however, in excluding the lost cases from calculation. All such cases have been classified in my series as recurrent. Nor can I entirely agree with his criticism of preoperative radiation. Wertheim used a cautery to clean up the cervix. It seems to me that radium is a very good method of cleaning up the cervix before operation and if the operation is done four or six weeks later we have an operative field that is clean, and there is less danger of implant metastasis. This, however, is not of much advantage where the lesion is less than 3 cm. in diameter.

The operability rate will vary with the institution. The lowest rate will be in a cancer hospital and the highest in university clinics and private institutions. I do not feel, therefore, that the operability rate has a great deal of significance. What is significant is the checking of our cases into groups, and we must be as honest as possible about this checking. If we adopt the League of Nations classification, comparisons can be more justly made.

The most interesting part of Mr. Bonney's paper is the report of the glandular involvement which I think was surprisingly high. In my own series where only Group II and a certain number of Group III cases were considered, the gland involvement was found to be 45 per cent. I am sure that in my Group I cases it would have been very much lower. It proves, however, very conclusively the necessity of considering metastasis in the gland in our treatment. Radiation effects upon cancer metastasis in the gland certainly have not been reliable. We have of course a certain number of sensitive tumors but in general no matter what may be the primary site of the cancer, the gland metastasis is better handled by surgery than by radiation, and I do not believe that the cervix cases are an exception in that respect.

I notice that when the glands were involved, Mr. Bonney's mortality was 20 per cent and there were only 22 per cent of five-year cures. That brings up the question whether we are justified in doing a radical Wertheim operation in the more extensive cases. If we do the glandular operation alone and treat the cervix by radiation, I think we will greatly reduce our primary mortality.

Since last year's report I have done 11 more operations of iliac lymphadenectomy for cervix cancer (a total of 39 cases in all) and have had but one operative death. I believe this operation therefore to be a safe procedure and one that is justified in the Group II cases.

In general my feeling as to the treatment of cervical cancer would be as follows: First of all, determine whether the case is a good operative risk. If there is obesity, if there is marked debility or extreme old age, if there are physical conditions such as a heart lesion or a kidney lesion or an endocrine condition that would make operation a material risk to that patient, then regardless of the involvement of the cancer I would not operate. However, let us consider what we would do if the case is a favorable one for operation: if it were a Group I case I would do a Wertheim operation with gland dissection since where it is limited to those earlier cases it is not so serious an operation. If we exclude the complicated cases we should get through with the Wertheim operation, have time to remove the iliac glands, and not lose more than 6 per cent of our patients.

In Group II cases I would on the basis of my experience thus far recommend the operation of iliac lymph gland removal with irradiation of the cervix. In Group III and IV cases I would recommend irradiation treatment alone.

DR. ARTHUR H. CURTIS, CHICAGO, ILL.—Unfortunately, in complimenting our guest on his technic, and in emphasizing the many operations he has so successfully performed, it is an inevitable corollary that we admit having reached approximately the maximum percentage of cures attainable by surgical means alone. Bonney's 33 per cent represents the greatest number of permanent cures obtainable by operative intervention.

I do not wish to discourage those who are advocates of radical surgery in the treatment of cancer of the cervix; their good work should go on. But statistics indicate that radium achieves an equal number of cures, with much lower morbidity and mortality. And we must remember that radiation therapy is still in its infancy, and the results are more and more satisfactory as our experience grows.

Stage I cases require no discussion; most of them may be cured either by operation or by radium. In patients with more widespread disease I have been greatly encouraged by the results obtained in my small series of cases with coincident surgical exposure and radium therapy, aided, as all cervical cancer cases should be, by intensive x-ray treatment.

DR. BENJAMIN P. WATSON, NEW YORK, N. Y.—Mr. Bonney has given us just such a presentation of his subject as we would expect from our knowledge of his writings and of his personality—clear, unequivocal, direct, and logical. Any man who has performed a particular operation 485 times has a basis from which to draw conclusions. He is to be congratulated on the reduction of his operative mortality from a high of 20 per cent in his early cases to 9.5 per cent in his more recent ones. I wonder if this mortality could not have been reduced further if more of the patients had had preliminary radiation to clear up the ragged, breaking-down carcinomatous tissue so often present.

I believe that in the present state of our knowledge regarding the behavior of the cancer cell, we are not in a position to be dogmatic about the treatment of cancer of the cervix. We all have seen cases in which radiation has absolutely failed to stay the course of the disease. We all have seen cases in which the radical operation in what appeared to be a very early case has been followed by death from cancer within a year or eighteen months. Our hope for the future must lie in the possibility of being more certain than we are now as to which type of cancer cell is radiosensitive and which radioresistant; which is more likely to metastasize early, and which late. Only then shall we be in a position to recommend with confidence radiation or operation or a combination of the two. The cancer cells are not all of the same type in the same case; the part removed by biopsy may differ materially from the rest of the lesion. Theoretically it would seem therefore that in the pres-

ent state of our knowledge the combination of radiation and operation in the so-called operable cases is the ideal when an operator with the skill of Mr. Bonney is available.

When such is not the case there can be no doubt that radiation alone will give the better ultimate results—with this proviso, that as it is unjustifiable for the inexperienced operator to attempt a Wertheim operation, so is it unjustifiable for the individual with no real knowledge of the technic of radiotherapy to treat the casual case.

DR. GEORGE GRAY WARD, NEW YORK, N. Y.—Bonney's work and large experience and the results he has obtained with the surgical treatment of carcinoma of the cervix represent the utmost we may hope to accomplish by pure surgery in this disease.

While his primary mortality in 483 cases is 14 per cent, in the last 200 cases he has reduced it to 9.5 per cent as a result of his experience and improved technic. When we consider that he has operated upon all cases whenever he thought there was any chance of completing the operation, his low primary mortality as compared with that of the average is remarkable and is proof of his great ability.

It is also remarkable that all his successful cases have not had the possible benefit of high voltage x-ray therapy, yet his survival rate approximates the best obtainable in any clinic whether surgery or radiation therapy has been employed.

I am glad that he gives us his ten-year results as well as the five-year, as we feel strongly that the ten-year period is of much greater value in estimating the actual cure rate. I am not quite so sure that we can agree with his statement that the ten-year period is a 100 per cent cure.

My records show one patient who survived eleven years and ten months and died after one year of symptoms from generalized carcinoma; another survived eleven years and two months and died of carcinoma of the pylorus; still another lived ten years less two months and died of the same condition.

His absolute five-year cure rate based on his assumed operability rate of 63 per cent is 24.6 per cent, and his relative rate is 25.6 per cent. This closely approximates the cure rate usually obtained by pure irradiation therapy in clinics here and abroad.

Our own five-year rate at the Woman's Hospital in 457 cases is 24.29 per cent absolute and 25.28 per cent relative.

Our ten-year cure rate of 17.79 per cent absolute and 18.31 per cent relative also approaches Mr. Bonney's ten-year figure of 18 per cent absolute and 20 per cent relative. Our figures here given were also obtained without the benefit of high voltage x-ray therapy. Our radium operability is 96.1 per cent.

As Mr. Bonney operated upon many well-advanced cases, it may be open to question whether the radiologist treating his 37 per cent inoperables can achieve a 12 per cent salvage in this group, which would give him a theoretical salvage of 30.6 per cent five-year cures.

The value of palliation by radium therapy should not be forgotten. The question of palliation should also be considered in the 14 per cent who died from the operation as compared to the 1 to 2 per cent primary mortality of radium therapy, as nearly all of this group would have survived radium treatment for varying periods.

Mr. Bonney gives his figures in two ways, uncorrected and corrected, the corrected figures by deducting those lost in the follow-up and those dead of other diseases. If we do likewise we naturally would improve our figures as we know of some 12 of our patients who apparently died of other causes. However, unless these cases were

autopsied, it is guesswork in many instances, therefore, the rule to class all cases lost track of or dead, as dead of cancer is probably more nearly accurate in the long run in estimating the value of the treatment.

In our recent report we have stressed the opinion of others besides ourselves that only the *absolute* figures which are based on all cases seen, not estimated, are of accurate value for comparison.

A comparative study of the late complications occurring after pure surgery or radiotherapy should be made. We know that complications occur some years after radiation therapy that are not necessarily of the nature of a metastasis or a recurrence, which may result in hydronephrosis, intestinal obstructions or pelvic pain. If such complications do not occur so frequently in pure surgery, we should know it.

We believe that our present results show that considering the lower primary mortality and the palliative value, radiotherapy offers the best for the great majority of these patients, as they otherwise must have the benefit of special technical surgical skill necessary to do a proper Wertheim operation.

But however we look at it, Mr. Bonney's figures are remarkable and show that a master surgeon trained in the Wertheim technic is essential to produce such wonderful results. His study of the gland involvement makes his classification of the extent of the disease far more accurate and valuable than is possible by those using radiation therapy alone. We must all admit that those cancer patients who have come under the skillful hands of Victor Bonney were fortunate indeed and have had as good a chance of recovery from this dread disease as was possible in any clinic, whether surgery or radiation therapy is employed.

DR. HOWARD C. TAYLOR, NEW YORK CITY.—There has been a tendency here among gynecologists and particularly among radiologists to think that irradiation is today the only treatment for carcinoma of the cervix uteri, that any advance in the treatment of carcinoma of the cervix uteri will be along radiologic lines, and that operative treatment no longer has any place in the treatment of any of these cases. This is wrong, as has been shown by Mr. Bonney's paper and the discussion of it. I do not know what the future treatment of carcinoma of the cervix uteri will be. It may be a combination of irradiation and operation. It may be operation for some cases and irradiation for other types. There is one point, however, about which there must be no question. It is a gynecologic problem. We as gynecologists have worked hard on this problem. Advances have been made by our work, and we must not yield it to the radiologists nor to cancer clinics.

DR. KARL H. MARTZLOFF, PORTLAND, OREGON.—It is interesting that the finding of carcinomatous lymph glands by Mr. Bonney in approximately 40 per cent of his operative material corresponds closely to the observations of Schottländer and Kermauner on Rosthorn's material and those of Weibel on Wertheim's material. The analogy ends however when one compares the 25 per cent incidence of five-year cures which Mr. Bonney has achieved in the gland-involved group with the experience of others in the same type of patient. This difference is forcibly emphasized when one contemplates the incidence of five-year cures obtained by Wertheim, Rosthorn, Bumm and Cullen's clinic which amount to 10.6, 4.1, 15.4, and 7.1 per cent, respectively. In fact the figures of Wertheim are based on patients who survived the operation and are therefore not entirely comparable.

Mr. Bonney's ability to salvage 25 per cent of his patients who had a carcinomatous lymph adenopathy, therefore, represents one of the outstanding achievements in the history of the surgical treatment of cancer of the cervix uteri.

I have been deeply interested for some time in a consideration of the subject which has for its purpose the justification of lymph gland removal in the operation for cancer of the cervix. Theoretically the procedure is logical and Mr. Bonney's

experience apparently offers practical proof of its value. However, it is obvious that in both groups of patients where extirpated lymph glands do or do not show cancer both may develop fatal recurrences and some of these undoubtedly represent lymph gland metastases. It is informative to note the incidence of fatal recurrence during the first two years after operation in Mr. Bonney's two groups of patients. In round numbers, this amounted to 32 per cent of those who had glandular involvement and 19 per cent of those without demonstrable involvement. This comparative difference is fairly uniformly maintained throughout the five-year period.

If one combines the primary operative mortality of 20 to 23 per cent, and the fatality from recurrences, during the first two years after operation among the patients with cancerous lymph glands, there is revealed a total mortality for the first two years of 55 per cent, and on the five-year basis this amounts to 69 per cent with a 24 per cent salvage.

A similar consideration of Mr. Bonney's patients who did not possess demonstrable lymph gland involvement reveals a total mortality for the first two years of 31 per cent (11.8 per cent primary mortality and 19 per cent fatal recurrences). On the five-year basis this comes to 40.1 per cent while the operative salvage reaches 51.3 per cent.

The difference is striking and I offer it because it is more or less lost sight of in Mr. Bonney's composite experience of an approximate 14 per cent operative mortality and a 39.6 per cent five-year rate of cure.

I have long doubted the wisdom of regional lymph gland extirpation in the abdominal operation for these tumors, because the high primary operative mortality, and the high incidence of early recurrence where lymphatic metastases have occurred seem to have robbed this procedure of any particular advantage it may appear to have possessed. While this point of view appears to be confirmed by Wertheim's incidence of 38.4 per cent five-year cures and an 8 per cent primary mortality following his abandonment of routine lymph gland removal, it appears to be even more strongly substantiated by the experience of those who are now practicing the radical vaginal operation where no effort is made to remove lymph glands. Here Peham and Amreich report a 3.6 per cent operative mortality and 48.7 per cent five-year cures; Adler reports 42 per cent cures (leaving out of consideration his experience with postoperative radiation) with a 3.8 per cent operative mortality, and finally Stoeckel, according to Schilling, has had a 4 per cent primary operative mortality with 58 per cent five-year cures in 150 cases.

In view of the foregoing it is still difficult for me to reconcile myself to the continued application of the ultraradical phase of the Ries-Clark operation for cancer of the cervix uteri, and I would appreciate knowing on what basis Mr. Bonney justifies the continuation of the effort at lymph gland extirpation.

DR. WILLIAM P. HEALY, NEW YORK CITY.—Mr. Bonney has told us that 44 per cent of his operable cases showed lymph gland involvement. It would be interesting to know whether cancer was present in those glands. If so, we must accept it as a fact that we cannot hope to salvage more than 50 per cent of the cases by radiation because radiation as we understand it today certainly does not cure cancer that is in the lymphatic glands at any distance from the cervix.

In the last series of any size that I reported from the Memorial Hospital of New York, a series of 1,600 cases of cancer of the cervix, we had a 46 per cent salvage in our operable cases. When you consider the lymph gland involvement, that is getting very near the top.

I would like to endorse Dr. Taylor's statement in regard to the gynecologist not giving up the treatment of cervical cancer or any other form of cancer in the genital tracts. If, however, it is decided to treat the disease it should be done as Dr.

Schwarz and others are doing, by developing younger men to be efficient in the treatment of cancer and not attempting to do both the surgical and the radiologic work because one cannot do them both well.

MR. BONNEY (closing).—I am not against preoperative irradiation. Some very remarkable results have been obtained by it; by Schlink of Sydney, for instance. What prejudiced me against it in the earlier days was that cases were sent us as having been rendered "operable" by radiation. These cases were very difficult ones. The radiation seemed to have destroyed the patients' resistance, besides causing dense fibrosis. I arrived at the conclusion that these cases would have been easier if radium had not been employed. An advantage of the course I have pursued is that my treatment has been purely surgical, whereas if I had used preoperative radiation the results would have to be shared between surgery and radiation.

As to preparation on the table, after trial of various antiseptics in the past I have for many years now limited myself to simply packing the vagina with gauze soaked in "violet green."

I agree with those who say that this is surgery's limit. We can go no further in surgery I am sure, whereas radiation has still no doubt an expanding future before it; but I do feel that the further progress of radiation depends on finding a method of destroying carcinoma in the regional glands. When this is achieved radiation will entirely supplant surgery. The fact that at present surgery can deal with these involved glands gives it a superiority over radiation.

What Dr. Taussig has said about iliac lymphadenectomy is very interesting because several of my colleagues and I have carried out the operation in suitable cases, but unfortunately I have not been able to keep in touch with all of my patients on whom I have performed this operation. The difficulty of keeping in touch with patients in my country is very great indeed. My Wertheim figures have been a purely personal matter with me, and even to obtain the figures that I have has been a big task. London is very large, patients shift around from place to place, and it is impossible to avoid losing touch with some of them. Follow-up departments are being established in our hospitals, and the men who come after me will find things easier in that respect.

What Dr. Ward said with regard to growths returning after ten years is very interesting. I have not personally seen a case. There is moreover no reason why a patient who has had Wertheim's operation should not develop an independent growth at some subsequent period. In that regard I cannot help noting what a large proportion of my cases of Wertheim's operation have had carcinoma operations in some other region of the body, either prior to or subsequent to my operation, and this suggests that certain persons have a special tendency toward carcinoma. Certain of these patients who have apparent recurrence after ten years really have a brand new growth and not a recurrence.

With regard to what Dr. Martzloff has said about glandular involvement, perhaps the difference in figures is explained by the fact that I have removed the regional glands in every case, no matter how early the primary growth, and they have all been examined microscopically. Wertheim on the other hand removed the glands only when they were definitely enlarged. I do not think it is so much the removal of the glands that increases the severity of the operation, but the advancement of the primary growth that accompanies the gland involvement.

One cannot look into the future, but I think it is quite possible that we shall one day see the end of surgery as a treatment of carcinoma of the cervix. There is, however, one advantage in operating over irradiating, and that is that you can keep the patient in absolute ignorance of her condition. She is told that she is bleeding and she is operated upon; she has no idea of what is the matter with her. She gets a recurrence and does not know what is the matter. She dies not knowing what is the

matter. The worst feature about irradiation in our country is that from the moment you start the treatment the patient becomes aware she has carcinoma, and though you may cure her physically, it takes a long time to cure her mentally. Patients who know they have had carcinoma and then get recurrence are distressing to watch. The return to radiation; the gradual realization of its failure, and the dread specter closing around—this is heartbreaking.

Finally there is this to be said for the operation; namely, that apart from its effect on carcinoma of the cervix, it has been and still is a great educational factor in gynecology, and it has raised the reputation of gynecologic surgeons in the opinion of surgeons in general, for the procedure is the most difficult of all surgical procedures. It has taught us the anatomy of the pelvis in a way that no dissecting-room preparations could possibly have taught, and it has enlarged the surgeon's vision, so that though in the future we may quite possibly see it replaced by a treatment more efficient, its disappearance from the field of gynecology will not be an entire gain.

11. **Physiologic Changes Occurring in the Urinary Tract During Pregnancy.** Drs. J. Mason Hundley, Jr., Henry J. Walton, John T. Hibbitts, Isadore A. Siegel, and C. Bernard Brack, Baltimore, Md. (By invitation.) (For original article, see page 625, November issue.)

DISCUSSION

DR. FREDERICK H. FALLS, CHICAGO, ILL. (by invitation).—In 1923 I pointed out that the dilatation of the ureter occurring in pyelitis of pregnancy was not a permanent change but rapidly disappeared after pregnancy was terminated. I was convinced by a study of autopsy findings in the ureter from a patient with pyelitis showing round-celled infiltration among the muscle bundles that the changes produced by the inflammation were not the cause of the dilatation since they would rather produce contraction. I also felt that the inflammation itself would irritate the ureter to spasmodic contraction rather than produce dilatation.

We have recently been able to show by means of the method shown yesterday by Adair, in studying the action of ergot derivatives, that an extract of the corpus luteum will completely inhibit the stimulating effect of 1 c.c. of obstetric pituitrin on the seventh day postpartum uterus when given hypodermically in one rabbit unit dose. We have also shown that this substance is valuable in the prevention of habitual and threatened abortion.

Kaltenschnee in 1911 showed that ureteral peristaltic waves were retarded in pregnant women and averaged 17.3 seconds longer interval between contractions on the affected side in pyelitis cases. This would seem to show that there was some interference with the normal stimulus to ureteral peristalsis during pregnancy.

Our explanation of the dilatation therefore would be that the antipituitrin action of progestin probably plays an important part in the relaxation of the ureter. Estrin, on the other hand, we believe can play very little part except through production of the hypertrophic changes in the sheath of Waldeyer, which, as pointed out by Dr. Hundley, does not explain the position of the dilatation.

As noted by Dr. Hundley, we find in our experiments with this hormone in the human uterus that its chief effect on motility seems to be to sensitize the uterus to pituitrin. One would expect this action therefore to increase the tone throughout the ureter unless we assume that the hypertrophy of the musculature at the lower end of the ureter responds so much more vigorously to the sensitizing effect of the estrin.

In the large fibroids one could explain the relative lack of dilatation by the fact of their relatively slow development, giving chance for ureteral hypertrophy and accommodation and by the fact that in such cases there is no change in the endocrine system corresponding to the pregnant state, by which progestin or other antipituitrin-like substance would be elaborated.

The position of the dilatation and its right-sided preponderance makes me feel with Dr. Hundley that pressure plays some rôle in producing the dilatation. However, the method of ureteral decompression as described in the paper is open to the serious objection that the long-continued presence of an indwelling catheter, plus repeated lavage of the pelvis with 1-1,000 silver nitrate solution, might stimulate ureteral spasm and thus bring about decrease in size. In order to be convincing, one would have to show that such procedure did not produce contraction of the normal or dilated ureter in nonpregnant women.

DR. GUY L. HUNNER, BALTIMORE, MD.—In 1925, in this JOURNAL, I reported some observations on cases of pyelitis in pregnancy and on cases of multiple abortion apparently due to renal insufficiency. In some of the latter class, one finds that after dilatation of bilateral ureteral stricture and restoration of better renal drainage, the patient who has had multiple abortions will carry through to term in subsequent pregnancies. Concerning pyelitis of pregnancy one cannot view a series of ureterograms, such as Dr. Hundley has shown, without marveling that any of these patients get by without developing pyelitis, yet we know that most of them do. Even in the comparatively few who develop pyelitis, many clear up spontaneously, as do many nonpregnant victims of pyelitis, simply by the routine of ten days in bed, proper posture, and forced fluids. Some ascribe these cures to the drugs given, but it is probable that rest, posture, and increased fluid intake, all of which promote better drainage, are the deciding factors. It is probable that in most of these pregnancy cases the drainage is not as sluggish as the ureterograms showing wide dilatation would seem to indicate, because of the muscular hypertrophy existing along the entire tract, especially in the lower portion, or in the sheath of Waldeyer. This general hypertrophy must accelerate propulsion of the urinary stream in spite of various external pressures, and I think it reasonable to suppose that the extra hypertrophy about the lower ureter may, by virtue of its stronger peristalsis, act as a suction pump to vacuum-clean the upper tract. These defense mechanisms seem adequate in most instances and most pregnant women escape pyelitis. As stated before, many of those who develop pyelitis are, with a little help, capable of spontaneous recovery. Those who do not recover spontaneously are often referred to the urologist. Adequate methods of investigation will show that practically all of these have ureteral stricture. In spite of the pregnancy most of them clear up promptly under treatment, by dilatation of the strictures, in addition to the simple methods which have failed until this further aid to good drainage is employed. In some the infection may persist until after the delivery, but the improved drainage results in cessation of fever and other signs of toxemia and enables the patient to carry to term.

Some indications in the patient's former history that invite investigation for the possible existence of stricture are the following: (a) a history of pyelitis in any previous pregnancy, (b) a history of a previous pyelitis attack in the current pregnancy, (c) a history of pyelitis at any former period of the patient's life, (d) a history suggesting the presence of stricture before the patient became pregnant, such as the combination of headache, backache, gastrointestinal symptoms, pains in the pelvic region, and urinary tract disturbances, no adequate cause having been found for these symptoms.

The author quotes Carson's pioneer work in which he found definite inflammatory stricture in 3 of 16 autopsies on pregnant women. Carson's explanation of these

strictures was that the pressure effects of pregnancy led to stasis with secondary infection of the urine, and consequent invasion of the ureteral wall resulting in local areas of stricture. My experience leads me to believe that such individuals probably had ureteral stricture before they became pregnant and that the stricture was a prominent factor in the subsequent urinary infection during pregnancy.

Pyelitis in the early weeks of pregnancy, especially if difficult to control, should arouse the suspicion of stricture. In testing for stricture in any period of pregnancy one must often employ larger preliminary bulbs than are used on the nonpregnant individual, because of the softened succulent character of the urinary tract tissues so well described by Hundley. Exceptions to this rule exist and at times the stricture areas are so dense as to mold down our smaller wax bulbs. To neglect the diagnosis and treatment of stricture, when it is present, is subjecting the patient to increased danger of future pyelitis attacks, or even more serious renal complications, as well as jeopardizing the general health.

12. **Recent Advances in Hysterography.** Drs. Thomas O. Menees, and J. Duane Miller, Grand Rapids, Mich. (By invitation.) (For original paper, see page 590, October issue.)

13. **Experiences With Amniotin in the Treatment of Gonococcal Vaginitis in Children.** Drs. Richard W. TeLinde, and James N. Brawner, Jr., Baltimore, Md. (For original article, see page 512, October issue.)

DISCUSSION

DR. CHARLES A. BEHNEY, PHILADELPHIA, PA.—The possible disadvantages of any new method of treatment should be considered. These preparations are uniformly expensive. They have been observed to cause changes in the secondary sex organs and Loeb, Engle, Selye, Collip and others have demonstrated carcinogenic properties in estrogenic substances when administered to animals experimentally. The shorter period of treatment required by this method by the use of estrogenic preparations, especially when the patients are hospitalized, more than compensates for the added cost of the preparations employed. Since vaginal application appears to be the most satisfactory method, there should be no difficulty in having the suppositories inserted by a trained nurse or some intelligent member of the child's family. If the hormone could be incorporated in an oily paste, dispensed in a collapsible tube with a suitable nozzle, the treatments would be simplified.

When one considers the short duration of administration required and the small dosage given as compared with these factors in relation to the experimental studies with small animals it becomes evident that the danger of carcinogenic activity is extremely remote and more theoretical than real.

The authors have suggested that recovery might be hastened if this treatment were supplemented by other measures. There is some danger that in cases where the hormone is injected under the skin there may be a great temptation to neglect to perform a careful vaginal examination in all instances. Dr. John Mitchell, of the Pediatric Service of Bryn Mawr Hospital, cites a case which illustrates the importance of thorough examination for every patient regardless of the treatment employed. This child had received large doses of amniotin hypodermically over a long period of time without improvement. The child was finally anesthetized and to his surprise examination revealed a hairpin in the vagina. After removal of the foreign body, prompt recovery ensued.

DR. THOMAS B. CARROLL, PITTSBURGH, PA.—Amniotin is certainly giving results that are very gratifying. The ease with which it can be administered is pleasing to the doctor as well as to the patient and is one of the principal recommendations. To be able to apply a treatment that can be more or less successfully carried out by the nurse or the mother decidedly recommends it. I am very much pleased and impressed with the results secured, for certainly the early administration would naturally have been attended with failure.

I usually expect very little of those preparations that have to be administered by mouth, and often not very much more from those which are administered hypodermically. The preparation in oil seemed to be attended with better results than that with ethylene glycol. Perhaps in the latter preparation there might have been some change brought about which was not occasioned by the use of oil and therefore gave the preparation a better chance. However, it is of very little importance to consider the various merits of the two preparations when one can get better results by the use of the suppository. The suppository is an age-old means of applying medicine of various sorts. So often does it fail that we give it little cognizance but here it seems to have redeemed itself.

There is only one new element that enters into the suppository and that is the vehicle that is used. I believe the preparation was made with glycerin. It is quite interesting to observe that with the glycerin there were no systematic reactions apparently, and I am disposed to wonder whether or not it was absorbed. If the preparation were absorbed in the vaginal canal there should be some reaction and it occurs to me that perhaps the amniotin was negligible, that it may possibly be that the glycerin alone so far as its superior result is concerned might have been responsible for the results attending the use of the suppository. I wonder if that would not be an enlightening thing if Dr. TeLinde would treat a series of patients, using the glycerin suppository alone in some and the amniotin preparation in others. Glycerin does not offer very much hope as far as the treatment of gonorrhea is concerned, but it has not been tried in this connection. Glycerin has certain properties that may render it helpful to this pathologic process. It may be that the advantages of the suppository treatment lie simply in the vehicle and not in the manner in which the amniotin is being introduced.

DR. ROBERT M. LEWIS, NEW HAVEN, CONN.—Since presenting to this Society the subject of the treatment of gonorrheal vaginitis with follicular hormone, two years ago, I have had the opportunity of acting as consultant in the treatment of these cases in Dr. Charles Hendee Smith's wards in Bellevue Hospital, New York. Dr. Helen Owen was in direct charge of the work. Although our results have not been as dramatically successful as Dr. TeLinde's, they have on the whole been highly satisfactory.

Of 61 patients treated with ethylene glycol amniotin, 48 have apparently been cured. Three cases were failures and 10 recurred. Like Dr. TeLinde, we found that even large doses of amniotin given orally produced no physiologic change in the vaginal mucosa. I have seen the desired reaction resulting from the oral administration of theelol in a few cases. A few cases of chronic vaginitis, not gonorrheal, have been treated and responded as well as did gonorrheal infections. Three hundred rat units of amniotin (ethylene glycol preparation) seemed the optimal daily dosage to effect vaginal changes. We did not try amniotin in oil.

Several cases of my own were treated with vaginal suppositories containing theelin, 50 R.U. each, twice daily. Of these, the first three or four did well. Subsequent cases failing to respond, we gave up the method believing that our suppositories had deteriorated. Dr. TeLinde's method of using gelatin capsules in the vagina is obviously an enormous improvement over the use of hypodermics.

Dr. James R. Miller reports treating 62 cases of gonorrheal vaginitis with follicular hormone (theelestrin) in his clinic and practice in Hartford. Of these only 8 resulted in failure.

In our series at Bellevue, 3 cases were of from six to twelve months' duration before receiving amniotin. Two had long-standing gonorrheal infections of from one to two years, and two more of two to five years' duration. These were all cured with amniotin. Cases of long standing appear to respond more quickly and favorably than do recent, florid infections.

Including Dr. TeLinde's report, we now have records of some 200 cases of gonorrheal vaginitis in girls treated with follicular hormone, the great majority of them successfully treated. In no case has the treatment caused any harm or injury. In not a single one has bleeding from the uterus followed when treatment was stopped. Apparently only brief transient alterations occur like the conditions always found in the vagina and breasts of the newborn female child. The many layers of vacuolated cells which make the vaginal mucosa of the parturient woman and newborn child histologically alike are artificially produced by administration of theelin. These many layers of cells may well be a natural protective mechanism against infection.

One must remember that although standardized, the preparations of estrin put out by the different firms vary in their effects. It is necessary to know the preparation that one is using and to administer enough to obtain the desired change in the vaginal mucosa. This can be measured best by biopsies along with microscopic examination of vaginal washings. The amount of estrin required to produce vaginal change in one individual may be insufficient to produce it in another. In some of our cases persistent rectal or urethral infections have been troublesome, reinfecting the vagina after it was apparently entirely clear of gonococci and discharge.

DR. NORMAN F. MILLER, ANN ARBOR, MICH.—We have from 6 to 20 of these children under treatment most of the time.

There are two inquiries I should like to make: the first concerns the criteria for cure. Many of our patients come from long distances, hundreds of miles, and we cannot discharge these patients until quite certain of cure. Consequently we have laid down a rule that each patient shall have three consecutive negative smears at weekly intervals following cessation of treatment. Even so some recurrences develop.

The second point is the matter of urethral infection. In our experience the gonococcus may be eliminated from the vaginal tract by the method discussed, but we find the occasional urethral involvement persistent and unresponsive to this type of therapy.

DR. FREDERICK J. TAUSSIG, ST. LOUIS, MO.—We apparently have in our hands a therapeutic agent that is effective in the treatment of gonococcal vaginitis. Is it not important now to give more thought to the prevention of this condition? When we consider the frequency of this infection in young girls it seems to me that we have neglected this phase of the subject. Twenty years ago I became convinced that one of the most common means of spreading this infection is in the early years of kindergarten and grammar school life when children congregate in large numbers in schools where the lavatory facilities are not properly supervised. I think that the careful supervision of girls at that time is a matter that should receive more attention.

I would like to ask Dr. TeLinde two questions: first, has he tried this form of treatment in vaginitis of nongonococcal origin? Second, has he examined the cervix of these girls to see whether any changes occur in the epithelium of the cervix; or has he taken any biopsies that would indicate that such changes occur?

DR. FRED L. ADAIR, CHICAGO, ILL.—I would like to call attention to work Dr. Davis has done on the appearance of vaginitis during the period of second childhood. The changes in the epithelium were apparently the same following the use of amniotin. It usually takes from three to four weeks to build up the epithelium and the process of upbuilding recedes in three to four weeks again, and it can be rebuilt by the subsequent administration of amniotin. We use principally the hypodermic injection, usually of 100 rabbit units three or four times weekly and sometimes that is combined with amniotin suppositories.

DR. C. FREDERIC FLUHMANN, SAN FRANCISCO, CALIF.—The use of suppositories represents a definite advance.

It seems doubtful that the modifications induced in the squamous epithelium are sufficient to account for the improvement which results, and attention should also be directed to certain biological changes. The infantile vagina has a low acidity, a high glycogen content, and the bacterial flora is composed mainly of cocci. After puberty, the pH advances farther to the acid side, the amount of glycogen diminishes, and bacilli make their appearance. It is quite possible that such factors are of importance in the control of infections.

In 1932 I presented before this Society the results of an experimental study in rabbits, in which it was shown that the administration of estrin enhanced the reactions induced in the pelvic organs by trauma. This manifested itself by vascular changes and the appearance of large numbers of macrophages. Since these factors are of importance in controlling infections, it was suggested that estrogenic substances be employed in the treatment of pelvic inflammatory conditions.

A small series of adult patients with pelvic inflammatory disease has been treated with amniotin, each individual receiving from 3,000 to 15,000 rat units over periods of from six to fifteen days. Without going into details, it may be stated that this method of therapy did not seem to offer any great advantage over conservative methods of treatment. However, there was one important finding in that the administration of amniotin seemed definitely to influence pain. Of 27 patients in whom pelvic pain was a prominent symptom, 10 had complete relief, 13 partial relief, and 4 were uninfluenced, within a short time after the injections had been instituted.

DR. NATHAN SEARS, SYRACUSE, N. Y.—There is one phase of gonorrheal vaginitis in children that I would like to emphasize, namely the relatively frequent occurrence of an accompanying cervicitis. This seems to be the cause of chronicity. I would like to ask if the amniotin has the same effect upon the cervical epithelium as upon the vaginal epithelium.

A second question: Does he wait any time at all for the acute stage of vaginitis to subside before placing the suppositories in the vagina?

DR. TELINDE (closing).—Replying to the question as to whether the amniotin or the other ingredients in the suppositories are responsible for the cure, I am so convinced of the ineffectiveness of the chemical therapy, I cannot believe that a little glycerin and carbolic acid in the suppository would have any effect. Also the fact that we get the same effect with the hypodermic treatment (although not so consistently) proves to me that it is the hormone that is doing the work. The weak point in the therapy were the recurrences which we had, but all of the recurrent cases cleared up promptly when retreated with suppositories. Of course, the question of reinfection always comes up. One child came back with a recurrence, strongly denying that she had had any sexual contact, but she had an anal chancre.

Replying to Dr. Miller's question about infection of the urethra, we saw no clinical evidence of urethritis, although we did not take urethral smears. I think it is possible that the drug given in suppository form may have an effect upon the

urethra as well as upon the vagina. A castrated woman came to us a few months ago with a reddened area about the urethral meatus. The lesion was not a caruncle but seemed to be covered with atrophic mucosa. It was the source of a great deal of irritation in that region. After trying all sorts of things without relief we finally in an experimental way gave her some vaginal suppositories of amniotin. The epithelium of the reddened area became thickened and the redness and irritation disappeared. Of course, that was not a gonococcal condition.

Answering Dr. Taussig, we have made no biopsies of the cervix. It would be reasonable to suppose that the vaginal portion of the cervix covered with stratified squamous epithelium undergoes some change as does the vaginal wall. We have no histologic data on this, however.

In regard to Dr. Davis' work, that is a problem which we ourselves have had in mind and the results are entirely in keeping with the laboratory work done by Hartman on castrated monkeys. The atrophic vaginal epithelium of the castrated monkey is just as demonstrated in the postmenopausal women. After all, in senile vaginitis we have much the same problem as in these children. The thin senile vaginal mucosa often has minute ulcerations allowing the vaginal flora to infect the subepithelial tissues. Thickening of the epithelium may be all that is necessary to allow the vaginitis to get well spontaneously.

We have had no experience with nonspecific vaginitis in children but it is our intention to try amniotin in some of these cases.

14. **Ovary-Stimulating Factors and Antihormones.** Dr. C. Frederic Fluhmann, San Francisco, Calif. (For original article, see page 584, October issue.)

DISCUSSION

DR. MORRIS A. GOLDBERGER, NEW YORK, N. Y. (by invitation).—Dr. Fluhmann has demonstrated a species variability of the inhibiting factor: that is: rats sensitized against human pituitaries would only inhibit ovary-stimulating extracts from human blood, and were ineffective to extracts from sheep pituitary. This brings up the question whether this phenomenon is really due to antihormones.

Is it not possible that the inhibitory effect ascribed to an antihormone is due to species antibodies? Anterior pituitary extracts prepared thus far are not entirely free of proteins. The infinitesimal amount of protein necessary to stimulate antibody formation is well illustrated by the work of Dr. Sabin, who, in trying to produce antibodies from tubercle bacilli grown on carbohydrate media, was unable to free them from proteins in the millionth dilution, and had produced antibodies against these proteins.

That there is a species variability in reaction to hormones is well known. Mice are more sensitive to the follicle stimulatory fraction than are rats, while rats, with more than double the weight of mice, give a greater response to pregnancy urine extracts. Monkeys, when injected with pregnancy urine extracts, show no follicular growth in their ovaries. Geist has shown the same is true of human ovaries by injection of antuitrin "S." These differences in response may be due to the ovary which Smith calls the end organ. Fevold, Hisau and Evans attribute this difference in response to the amount of circulating prepituitary hormone in the individual, which augments or activates the extract injected.

Variations in reactivity of the ovary in the same species to stimulating factors found in pregnancy urine have been apparent to us for some time. In September we reported that in over a thousand Friedman pregnancy tests done in duplicate at our laboratory, we found that 3.5 per cent of the rabbits were refractory—that is, one rabbit would be positive showing blood spots, and the other rabbit negative

showing normal ovaries. In doing the test in duplicate, we have been able to reduce the errors from 5.5 per cent to 0.5 per cent. In the last 265 Friedman tests, we have also observed 6 instances (2¼ per cent) in which one ovary in the same rabbit showed blood spots while the other was negative.

The variation in the reactivity of the ovaries in the rabbits observed by us may be due to a difference in the responsive capacity of the ovaries rather than a difference in the potency of the pregnancy urine or to an antihormone. This would explain the reaction of only one ovary in the same rabbit. Aging processes of the ovary decrease their capacity to respond. This is well shown in the ovaries of women in the menopause. Here there may be large amounts of follicle stimulating and luteinizing hormones (as recently shown by Frank), yet no follicle ripening occurs.

To sum up: The evidence so far shows that under certain conditions, refractiveness to a given quantity of hormones may develop, but the explanation as yet is by no means convincing that this is due to a species antihormone. The possibility exists that the prepituitary hormone actually contains protein as part of its molecule—in which case this would be understandable. Personally, I prefer to adhere to the opinion of those who defer the final interpretation until a crystalline prepituitary hormone has been obtained.

DR. KARL M. WILSON, ROCHESTER, N. Y.—Isolation of the ovarian and other hormones has led us to hope for a great deal from the therapeutic standpoint—probably we have been hoping for too much. The demonstration of the fact that the body can develop more or less specific antihormones adds another phase to an already difficult and complex problem. Dr. Fluhmann offers the suggestion that there might be some therapeutic value in the antihormone. Where an individual's symptoms are the result of an overproduction of a certain hormone, theoretically at least, if the development of a specific antihormone could be stimulated in the body, the symptoms should be overcome. Again theoretically, the converse might well be true. That is to say, if we can definitely demonstrate that a patient's symptoms are due to the lack of a certain hormone, and she is given that hormone in a therapeutic manner, this may be followed by relief of the symptoms. However, if given in sufficient quantity and over a sufficient length of time, administration of this hormone might well result in the development of an antihormone, thereby nullifying the results of previous treatment.

For the present at least, this, of course, can only be considered on theoretic grounds, and it is impossible to make specific statements from the standpoint of therapy. Along this line, I have in mind a patient whom I have observed for the past one and a half years who has been suffering from excessive uterine bleeding which we believed due to an underproduction of progestin. During the past year she has been receiving hypodermic injections of progestin with extraordinarily satisfactory results until a couple of months ago, but since that time it has failed to stop the bleeding. I do not know what that means—whether the administration of progestin stimulated the overproduction of an already too abundant amount of estrin, or whether she developed an antihormone which nullified the effect of the progestin therapy. All this offers an interesting problem to speculate on, and it may have very distinct possibilities.

15. **Some Newer Aspects of Reproductive Physiology.** Dr. Emil Novak, Baltimore, Md. (For original article, see page 495, October issue.)

DISCUSSION

DR. ROBERT T. FRANK, NEW YORK CITY.—The first time that I brought up the subject of endocrinology in this Society was twenty-four years ago. Times

have changed since then. At that time we knew only of the corpus luteum as the active sex factor. Today we have to consider the pituitary, the follicle elements, the corpus luteum, and now from the work that Dr. Novak refers to, possibly a sex center. Formerly his views and mine differed much more than they do now. In crude analysis he is a romantic in medicine, I am a realist. His function is that of an observer in an airplane up in the air over the battlefield to see what is going on below, to get an outline of the general action; mine has been in the trenches. I have not been alone. I have been helped by an enthusiastic group of collaborators. However, my outlook and his have naturally been at variance.

I will refer to only a few of the achievements that Dr. Novak has emphasized. As far as anovulatory or pseudomenstruation is concerned, I think that phenomena can be accepted but with some reservation. Schroeder and Geist first pointed out this form of abnormal bleeding. Others (Hartman) have shown that a menstrual cycle can occur without a corpus luteum forming. The deductions, however, made from such a technic as suction curettage—I think the term suction biopsy would be preferable—must be accepted with great reserve unless the result is positive. If you find a secreting area of endometrium you may say that the evidence favors ovulation. If, on the other hand, you get a negative result, I would even distrust a thorough and complete curettage, if negative, unless such sections had been very thoroughly examined. Therefore, one must be warned against drawing conclusions from a single section of the uterus because if you remove the uterus you may find quite different cyclical changes in different parts of the endometrium.

That removal of the corpus luteum produces bleeding was brought out in 1905 (Fraenkel) but that it should be made a determining factor in bleeding is not warranted because, as was agreed after a long controversy, the human corpus luteum also secretes large quantities of estrin, so we need further clarification before this point is settled.

As Dr. Novak emphasized that he wanted to bring out the newest advances in endocrinology, I believe it a good opportunity to mention a few of our own laboratory discoveries which are in press, and give you some information in advance. By improvement of technic Dr. Salmon and I have obtained the concentration of the prepituitary factors in the blood and in the urine quantitatively much richer than before, with astonishing results. The surprising thing is that heretofore we have considered the pregnancy reactions, namely the Aschheim-Zondek test, as strictly associated with pregnancy. Our findings disprove this.

Dr. Goldberg and I have also recently improved our female sex reaction in the blood and urine to such an extent that we can obtain a positive reaction with 40 cm. of blood, even immediately after the menses. Though our quantitative results are greater, we are glad to report that so far as the graph of the cycle is concerned there has been no change. Geschickter and Lewis, as Dr. Novak told you, describe large quantities of sex hormone in adenomas of the breast and in fibroids. Consequently it became necessary to look for controls and we have selected the psoas muscle which is readily obtained at autopsy and we found that the amount in the psoas muscle is as great or greater than the amounts that they found in tumor tissue. This leads to two deductions: first, that the mere presence of estrogenic substances is not an indicator of action; and second, that very possibly this elusive estrogenic factor which disappears out of the blood may be stored as glucose is stored, perhaps in the muscles, possibly in other tissues.

The first suggestion offered by Dr. Novak is that of the relation between the sterol substances, as possessing carcinogenic qualities, and the hormones. May they or their derivatives not be that thing which makes it necessary for the embryonic epithelial cell to split prematurely and then invade? The similarity, then, chemically, between these substances and the hormones naturally suggests the theory

that the hormones may be factors in tumor growth. For a number of years I have thought of the irritative factor in the production of cancer as much more probably a chemical than a mechanical one.

The relation between the hormones, especially those of the gonads, is another suggestive thought in connection with this work. Also the relation between the sex glands and the neurovegetative system which was brought out some years ago by Maranon.

Of most interest to me is Dr. Novak's discussion of anovulatory menstruation. It has been my good fortune to provide the material for a histologic study of the uterine mucosa, both in menstruation and otherwise, and to follow the work done by Bartelmez at the University of Chicago. I have also seen the development of this work which has been finally published, at least in part, and we came to the conclusion some years ago from the histologic examination of the mucosa alone, that there could be menstruation without ovulation. It may not have been presented in such a way as to convince everyone, but at least we felt sure ourselves that a woman may go on menstruating even if the follicle did not rupture and there was no corpus luteum. This may be due, in part at least, to an absence of the ferment in the liquor folliculi, claimed by Fränkel some years ago as an aid in breaking down the overlying structure. Hence, if the follicle were deficient, for some reason or other, in this ferment, this might help to explain why the follicle does not rupture and a corpus luteum result.

I feel, however, that the examination of the corpus mucosa by Dr. Novak's aspiration biopsy would be effective in a certain number of cases only where the changes were definite. Our experience is that these changes vary, especially in association with a cystic follicle as is apt to be the case, and that these changes show a gradation which is not always definite enough. It is a question whether in every case it would be possible by this biopsy to determine if the menstruation is anovulatory or not. Further, anovulatory menstruation is undoubtedly a factor in certain cases of sterility. There is not time to go into this at length but it occurs to me that perhaps a sterility of this type might be an explanation of what we have called "biologic incompatibility."

DR. NOVAK (closing).—I believe that Dr. Frank is under a misapprehension as to the amount of tissue obtainable by our method of aspiration-curettage. We can easily remove as much as we like, even practically all the uterine mucosa, and this can be done almost always without anesthesia and with no great pain. In asking for serial sections, he is demanding an unreasonable criterion, and, I believe, an unnecessary one. By our ordinary laboratory technic the curettings are bunched and a number of sections taken at different levels. There is never any difficulty in recognizing secretory changes, even histologically, in the immediately premenstrual endometrium of the ovulating woman, so that differential staining is only confirmatory. Absence of secretory changes by similar criteria is, to my mind, to be interpreted as indicative of an absence of progestin and therefore of ovulation. I do not believe that the cutting of serial sections would alter our conclusions in any way.

Dr. Frank attacks the findings of Geschickter and Lewis at a vulnerable but not a very pertinent point. I fully agree that the mere finding of large amounts of estrogenic hormone in various tissues has very little significance. For that matter, these authors report finding large amounts of prolan in a large lipoma, though no one would ascribe any causative influence to this hormone substance as related to lipoma. But the actual production of neoplastic conditions by giving large amounts of estrogenic substance, as reported by the investigators quoted in my paper, is another story, and the one related to the present discussion.

I agree also with Dr. Frank's emphasis upon the quantitative factor in hormone relationships. I have repeatedly stressed this in the discussion of anovulatory menstruation. I do not believe, as Kurzrock seems to do, that prolan A is the ovulating factor, nor that prolan B is the one especially concerned, as some of the British investigators suggest. The evidence points to the fact that a rather delicate quantitative balance between the two principles is necessary for the occurrence of ovulation.

In my paper I have shown that an increasing number of gynecologists are encountering anovulatory menstruation in the study of sterile women, some much more frequently than we do. Some, indeed, report an incidence so high as to cast doubt upon the accuracy of histological study.

16. **Analysis of End-Results of Labor in Primiparas After Spontaneous Versus Prophylactic Methods of Delivery.** Drs. Albert H. Aldridge and Paul Watson, New York City. (For original article, see page 554, October issue.)

DISCUSSION

DR. CLIFFORD B. LULL, PHILADELPHIA, PA. (by invitation).—Dr. Aldridge stresses morbidity. I believe that this is important because from the many articles that I have read in lay magazines, it seems that the public know more about maternal mortality than we do. Therefore a discussion of morbidity rather than mortality seems to be in order. Since 1922 we have gradually increased the number of operative deliveries. I do not mean interference in obstetric cases, particularly in cases of abnormalities of the mechanism of labor, but rather an increase in the number of so-called prophylactic operations. We have just had the experience of observing a series of 1,600 patients who were given nembutal and scopolamine in fairly early first stage labor, and we have been particularly impressed with the decrease in the number of operative deliveries, such as version and midforceps, but have also of necessity increased the number of prophylactic forceps. It is almost always necessary to deliver these cases under light nitrous oxide anesthesia in order to keep them quiet on the table. We are fairly certain that the use of analgesia when used more extensively, will decrease the number of difficult operative deliveries. Our practice is about the same as Dr. Aldridge has outlined for you.

As to perineotomy, I am in accord with the practice of doing a central incision. Occasionally this will tear into the rectum, but as it is so seldom, I do not believe that it should deter one from using the midline. We do the perineotomy fairly early and remove the forceps from the head as soon as it can be controlled in the vulvar outlet.

Our handling of breech cases differs in that we extract a rather high proportion when the cervix is completely dilated rather than to allow them to go on spontaneously. We do this under general anesthesia. We are particularly careful not to give the patient partial anesthesia when part of the child is delivered, as we feel a partially anesthetized patient being delivered of a breech presentation very frequently gives rise to difficulty in the extraction of the head.

Our incidence of version has decreased very considerably during the past few years, particularly since we are using more analgesia.

We have not accepted the low cervical section as a routine procedure. When the operation is done at the time of election, we do the low classical; if the patient has been in labor, has been examined, or has ruptured membranes, we do the low operation. I believe, however, that in the last few years we have unquestionably given more cases a test of labor than we did previously. Our statistics are about the same as Dr. Aldridge's.

In discussing the question as to what undergraduate students should be taught, I, too, like to feel and believe that we should teach the students to do what we do, but it does not seem to me that the time has arrived as yet when the general use of prophylactic forceps should be taught to students who are going to practice obstetrics in poorly equipped hospitals or homes. In other words, the use of obstetric forceps as a routine procedure should be done in well-equipped hospitals and by men who have had special training. If we could teach the students to recognize abnormalities and complications, and teach them that the complicated case should be handled by the man particularly trained in this work, we would do a great deal to reduce obstetric mortality and morbidity.

DR. WILLIAM C. DANFORTH, EVANSTON, ILL.—A study of neonatal mortality recently made covering the work of the past five years cared for in the obstetric division of our service has indicated quite clearly, so far as our service is concerned, that the rather liberal use of outlet forceps by a staff of trained men does not increase fetal mortality or morbidity. A comparison of the cases delivered by outlet forceps shows that the result, so far as the infants are concerned, is somewhat better in the outlet forceps group than in those which were spontaneously delivered. It must be understood that this statement is sharply limited to outlet forceps cases. A moderate number of midforceps cases showed a sharp rise in infant mortality. It must always be understood that the liberal use of forceps delivery presupposes two things: first, that the liberality extends almost entirely to low or outlet operations; and second, that the operations be done skillfully. As the essayist has indicated, it is a procedure for the skillful obstetrician in a well-equipped hospital. An outlet extraction done with full knowledge of the mechanism of labor, the last portion of which the extraction is designed to replace, and with adequate understanding also of the technic of the forceps operation, is a highly innocuous procedure. This is not true of roughly or unskillfully done operations. It has seemed to us that the total sum of trauma to which the head is subjected is greater when the head is allowed to be compressed by a strong contraction against a rigid perineum than it is when a timely episiotomy is done and the head gently disengaged from the birth canal by outlet forceps. It also enables the obstetrician to perform incision of the perineum, if this is needed, deliver the baby, express the placenta and suture the perineum under one anesthetic, thus decreasing considerably the discomfort of the mother.

In the use of perineal incision, also, I find myself in agreement with Dr. Aldridge. Particularly in primiparas a timely episiotomy, done before the levator muscles have been separated by the advancing head, and followed by a careful repair, is far more effective in preserving a good perineum than an attempt to deliver without incision. In the latter event the musculofascial structures of the pelvic floor are likely to show a lesser degree of integrity eight weeks after labor. I am quite in accord with the essayist's statement that abnormal pelves, faulty presentation and disproportion are far more active causes of neonatal trauma than properly done outlet forceps deliveries. The same is true as to maternal injury.

Our experience has quite clearly indicated that neonatal deaths during or after operative deliveries accomplished by the exhibition of greater force than is needed in the simple outlet forceps delivery in the majority of cases is caused by intracranial injury. Our efforts, therefore, have been directed toward decreasing as much as possible these more traumatic deliveries. To this end patients and analgesic agents contribute materially. The neonatal mortality in cases delivered by various procedures is indicated in the following table:

EVANSTON HOSPITAL 4,924 CASES

	TOTAL DELIVERIES	FETAL MORTALITY	FETAL % MORTALITY
Spontaneous	2,456	17	0.69
Low forceps	1,826	8	0.43
Midforceps	161	8	4.96
High forceps (2 cases only)	2	1	50.00
Breech ext.	158	7	4.43
Version and ext.	102	10	9.80
Low cervical section	219	12	5.48
Total	4,924	63	1.27

DR. NORRIS W. VAUX, PHILADELPHIA, PA.—Coming from a Philadelphia Clinic which has always been considered radical in its care of these cases, this very interesting paper of Dr. Aldridge's strikes a pleasing note. At our clinic we are very prone to have a great many emergency cases. The mortality in these cases without adequate prenatal care is very striking when compared with those who have attended our prenatal clinic, where we do not consider prenatal care adequate unless a patient has made at least three visits. In our series in over four and a half years, there was a large proportion of cases which, apparently due to the economic distress, had very inadequate prenatal care, and in this group the fetal mortality was very high.

The fetal mortality in our clinic, based on a five-year period, showed 58 deaths in 182 cases of breech delivery, an incidence of 1 fetal death in every 3 breech deliveries. In 1,972 cases delivered spontaneously, there were 189 fetal deaths, or 1 in 10.5; excluding a number of tiny prematures which dropped into the vaginal canal in this group of cases delivered spontaneously, brings the incidence to 1 in 36.7 as compared to the fetal mortality incidence in those cases delivered by forceps application, which was 1 in 41.6. There were 31 deaths following cesarean section, a fetal mortality incidence of 1 in 10; in this group there were a large number of emergency cases as well as toxic cases.

DR. EDWARD A. SCHUMANN, PHILADELPHIA, PA.—The papers plus the discussion have shown conclusively that mortality and morbidity may be reduced by the proper use of prophylactic forceps, limited to the skilled obstetrician in a well-appointed hospital.

MR. VICTOR BONNEY, LONDON, ENGLAND.—The paper is particularly interesting to me because there has been a very strong feeling against obstetric interference in our country and many well-known obstetricians inveigh against it. The reason is that the vast majority of women in our country are confined in their homes and are attended by the ordinary practitioner.

The paper bears out what I have always thought, that if the full gamut of surgery were applied to obstetrics much of the danger to the child and mother could be abolished. Unfortunately in England much of this work is not done under expert conditions. It would be difficult to get this practice applied in our country at large. We shall have to teach our students that, given expert conditions, it can be done advantageously but we must impress upon them that such practice is only justified where good conditions and expert knowledge prevail.

DR. J. C. LITZENBERG, MINNEAPOLIS, MINN.—This paper has done a desirable thing and that is to crystallize our ideas about the proper delivery of women, and about what is conservative and what is radical. It is not radical to do a cesarean section on a contracted pelvis through which the baby cannot go. It is not radical to do a high forceps when it is indicated. We have been doing this for ten years

in the University Hospital. It is not radical to do a midforceps operation when it is indicated. The low forceps is not to be classed with forceps operations in general as a radical procedure. I have been among those who have fundamentally condemned and still condemn the promiscuous employment of cesarean section, or ill-advised forceps operation, or version, but I have been compelled during this time to find out by experience that the outlet forceps application is a conservative procedure, a life-saving one for the baby in many cases.

We have already heard in this discussion from New York, Philadelphia, and Chicago and you are now hearing from Minneapolis that we have been thinking along similar lines and developing our ideas regarding the outlet forceps operation and the episiotomy. I agree with the method of doing an episiotomy, usually central, sometimes midlateral, and, in versions, laterally.

The mortality and morbidity in high forceps operations even in skilled hands are still high. The mortality and morbidity in midforceps is about half as high, but in skilled hands the mortality and morbidity are as low with the outlet forceps operation as in spontaneous delivery. When I use the term "outlet forceps" I mean application of the forceps really at the outlet, with the pelvic floor distending, and not their application when the head is only to the pelvic floor. We must make a distinction between "low forceps" when the head is on the pelvic floor and "outlet forceps" when the floor is distended and the head visible. The latter is a conservative procedure, the former is attended with almost the same dangers as "midforceps."

DR. JOSEPH B. DELEE, CHICAGO, ILL.—About fifteen years ago I brought before this Society a paper on the prophylactic forceps operation. I was not the father of prophylactic obstetrics in the second stage but I do claim, perhaps immodestly, that I was the accoucheur who delivered the idea. Prophylaxis in this field of obstetrics preceded me by many years. My teacher, Prof. Jaggard, taught episiotomy, which was heretical obstetric practice in 1889. The prophylactic forceps operation was proposed not on statistical grounds, but as the direct result of my own personal observation of thousands of cases and a study of the pelvic floor after delivery, in both living and dead women. I took the opportunity to make anatomical dissections of several women who died of hemorrhage or rupture of the uterus, immediately after death and I came to the conclusion that a spontaneous delivery usually causes more damage to the pelvic floor than an episiotomy and forceps. Some women will not tear. They will deliver nine- or ten-pound babies and the pelvic floor and bladder will be in good condition. If examined several years afterward you can hardly tell that they have had a baby, but those women are rare. There are a large number of women who will tear no matter how deep the episiotomy is made; it seems that the tissues have no resilience or elasticity whatever. Now, under my more or less empirical prophylactic forceps operation Dr. Aldridge has put a statistical basis.

It has been said that prophylactic operative measures should not be taught to young men to be practiced in the home. I have had an enormous experience with women delivered at home, covering at least 60,000 cases. Among the last 10,000 patients delivered in their homes by the Chicago Maternity Center, 12 women have died and only 2 might be chargeable to the service. This includes all patients sent to the hospitals and women who have had even one visit or only a telephone call to the Center. In the last 3,300 deliveries not one woman has died. The morbidity of these women has also been low in comparison with those delivered in hospitals, and a large number of prophylactic deliveries were done in these homes.

DR. ARTHUR H. BILL, CLEVELAND, O.—I have used prophylactic forceps routinely, for more than twenty years. In recent years in the University Hospitals in

Cleveland there are delivered each year about 3,000 women by operative means. The reason we do this is because we are thoroughly convinced that we do not increase the mortality or morbidity in this way.

Some years ago Dr. Reycraft gathered together an extensive series of cases from my service delivered spontaneously and a similar number delivered by prophylactic means. The morbidity was no greater in cases where operative interference was resorted to. I believe that with proper prophylactic methods maternal mortality and morbidity are not increased. I think the fetal mortality is perhaps decreased.

Enough stress has not been laid upon the proper prophylactic methods. Very little has been said about when to interfere and about the cervix. Now all of these prophylactic methods should be in second stage deliveries. The minute the doctor starts to interfere before the cervix is completely dilated he is heading for trouble. The secret of our success has been largely due to the fact that we are very insistent upon allowing the first stage of labor to take its full course, except in emergencies when we do not hesitate to interfere either by the low prophylactic forceps or by the correction of abnormal positions.

A short time ago I reported before this Society a series of 500 occipitoposterior cases which I had personally delivered by operative means, and another series of 500 posterior cases delivered by operative means by the resident staff. Since then I can quote a series of 200 consecutive posterior cases which I have personally delivered. All of these cases were carried through labor, painlessly from start to finish, delivered with complete anesthesia by operative means, either by forceps rotation or by podalic version and with no mortality. Of the 200 cases there are 199 babies living today. The one which died was a case in which there were anatomical defects which were absolutely inconsistent with life. I simply quote these figures to show that prophylactic means can be carried out if done properly and at the right time. I again want to emphasize the reason why there is not success in a large per cent of these cases. It is because interference is done too early and resorted to when the cervix is not obliterated.

DR. THOMAS B. CARROLL, PITTSBURGH, PA.—Pittsburgh has arranged to compensate in a modest way the physicians and hospitals taking care of maternity patients who are on relief. There have been thus far some 6,000 patients delivered. The requirements for the care of these patients consists of a certain amount of prenatal care; they must receive eight prenatal visits where there is sufficient time; the urine must be examined, certain attention given during delivery, and a certain number of visits made following the delivery. About 60 per cent of these cases have been delivered in their homes, 40 per cent in the various hospitals. Up to the present time there have been 6 maternal deaths. In spite of practice by inadequately trained doctors, the mortality has been reduced to something like 1 in 1,000 deliveries. Out of those 6 deaths one was caused by self-induced abortion resulting in septicemia; another by her husband who came home late at night and kicked her into unconsciousness. This patient was taken to a hospital with separated placenta; cesarean section was done and she died. These deaths should not be attributed to the obstetric practice but to the lack of obstetric care.

17. **Protein Stabilization in Preeclampsia and Eclampsia.** Drs. Boyd Harden, W. S. McEllroy, and R. R. Huggins, Pittsburgh, Pa. (For original article, see page 524, October issue.)

DISCUSSION

DR. H. J. STANDER, NEW YORK, N. Y.—The present authors, in this thorough study, have corroborated the findings of Mendenhall and Smith regarding the use of heparmone in the treatment of eclampsia.

As to the second part of their paper, dealing with high protein diet, I am inclined to agree with their deductions. Strauss in a recent paper has attempted to show that a restricted dietary intake of protein in pregnancy may be actually harmful.

One of the main manifestations of eclampsia is water retention, according to the very old edema theory of Traube and Rosenstein. This may be due, in some measure, to the lowered osmotic pressure of the plasma proteins. There is general agreement today that the albumin fraction is lowered and the albumin-globulin ratio decreased. Strauss has also shown an increased venous pressure accompanying the lowered oncotic pressure.

High protein diet, therefore, may be of actual help in the treatment of this disease, on the basis that the osmotic pressure within the blood stream may be raised by restoring, in part at least, the concentrations of the various serum protein fractions. Could this be accomplished by the high protein diet, then there must of course follow loss of water, held in the tissues, in order that equilibrium may be maintained and such processes as osmosis and diffusion continue in the desired directions. Even in nephritis our dietary treatment is today toward high protein rather than low protein diet. I have never advocated the use of low protein diet in eclampsia and preeclampsia, but I have done so for nephritis. I am free to admit I may change my views.

DR. WILLIAM J. DIECKMANN, CHICAGO, ILL.—Dr. Huggins and his coworkers have stated that there is a significant decrease in the serum protein in the toxemias of pregnancy. They ascribe this decrease to an insufficient protein intake and/or excessive loss of protein in the urine. There is no doubt that if the serum proteins become markedly decreased edema may occur, but it may also subside without any increase in the serum protein concentration. The serum protein concentration in the toxemias rarely reaches the edema level. The most striking phenomena is that simultaneously with or shortly after delivery, or the death of the fetus, the patient shows clinical improvement with the serum proteins decreasing to a concentration less than that found at the height of the disease. If the decrease in serum protein is the cause of the edema and of the associated symptoms and signs, a blood transfusion or a transfusion of plasma protein should cure the condition. We have transfused toxemic patients without noting any improvement.

Another method of raising the serum protein concentration, or rather the colloid osmotic pressure, is by the injection of gum acacia solution. Hartmann has been able to keep children free of edema for as long as two years with repeated injections of acacia. Some of the children have eventually been able to produce their own serum protein and have recovered, while the others have ultimately died. We injected acacia solution into several eclamptic patients with phenomenal results, but we did not ascribe the clinical improvement to the increase in osmotic pressure but rather to the blood dilution.

It should be noted that most of the patients developing eclampsia have not been on a starvation diet. Furthermore, prenatal care, an essential part of which is proper elimination and proper diet, in the past two decades has lowered markedly the incidence of eclampsia. The decrease in the number of cases of eclampsia that occurred in the Central Powers during the War has been ascribed to the decrease in protein intake. During the period of the depression our dispensary patients are

all on a low protein intake because of the financial condition, and yet the number of cases of eclampsia has certainly not increased.

The essayists have stated that in eclampsia large amounts of albumin are lost in the urine. During the acute phase of the disease the concentration of albumin in the urine may reach 4 per cent or 40 gm. per liter; but during this period the volume of urine is usually only a few hundred cubic centimeters. In others words, the total excretion of albumin per twenty-four hours is well under 10 gm. per day, and as a rule it requires a loss of at least this much to decrease the serum protein concentration.

Dr. Huggins and coworkers have accumulated a mass of valuable data and should be commended for directing attention to the importance of nitrogen metabolism especially where there is a prolonged albuminuria. However, in view of these various observations, it does not seem reasonable to ascribe their reported results to the increased protein intake.

DR. HARDEN (Closing).—We will answer Dr. Dieckmann's question indirectly by stating that the effect of feeding maintenance amounts of protein does not necessarily result in elevation of the total protein of the plasma. Further, we have not observed high negative nitrogen balances in asymptomatic albuminuria.

The formed elements of the blood in each of these cases rested in levels approximating normal for uncomplicated pregnancy. Blood chemistries reveal no striking abnormalities.

In the case of preeclampsia the total twenty-four-hour nitrogen output was 6.07 gm. The nonprotein nitrogen (which means that portion of the total nitrogen which is not precipitated by the ordinary protein precipitants) was 3.89 gm. Translated into protein equivalents the total nitrogen represents 37.9 gm. of protein, of which 24.3 gm. is nonprotein nitrogen. This individual required 61 gm. of protein to satisfy maintenance demands. She, therefore, metabolized less than half her normal requirement of protein. On admission, 64 per cent of nitrogen was in the form of nonprotein nitrogen, while the urea fraction of nonprotein nitrogen was 29 per cent. Protein loss was 13.6 gm. Under eleven days of the regime of protein stabilization the nonprotein nitrogen fraction of total nitrogen was elevated to 89 per cent, while the urea fraction of nonprotein nitrogen reached 58 per cent. Her protein loss fell to 4.12 gm. in twenty-four hours.

It is of interest to note that this patient had a digital abscess and in following her protein loss from day to day, we were unable to secure a substantial reduction in this loss until the abscess had been drained by wide incision.

In the case of eclampsia the total twenty-four-hour nitrogen on admission was 10.49 gm., or 65.25 gm. of protein. The nonprotein nitrogen fraction was 6.25 gm. of nitrogen, or 39.06 gm. of protein. Her protein loss was 26 gm. The urea fraction of nonprotein nitrogen was 42 per cent. After twenty-two days under protein stabilization the nonprotein nitrogen fraction of total nitrogen was 90 per cent, while the urea fraction was elevated 83 per cent. Protein loss at this time was 2.6 gm.

These results are offered with the hope that others may find them useful, and in using the regime contribute to a further knowledge of the fundamentals of protein metabolism in normal and complicated gestation.

18. **Theca Cell Tumors.** Dr. Samuel H. Geist, New York, N. Y. (For original article, see page 480, October issue.)

DISCUSSION

DR. CAREY CULBERTSON, CHICAGO, ILL.—Last year I showed before this Society certain microphotographs and microscopic slides of ovarian tumors that were hormone producing. Among these were granulosa cell and theca cell tumors. In his presentation at this time Dr. Novak grouped together the granulosa cell and theca cell growths, on the basis that the two were of common origin. He thought it best from the clinical point of view, also for teaching purposes, to regard them as of one group. At that time I pointed out that while this made for simplification clinically, the pathologist probably would not accept a common grouping of the two tumors. We now have Dr. Geist's admirable presentation of fine specimens of theca cell tumors.

In my limited experience with these structures I have seen chiefly the granulosa cell growths but have had the privilege of studying three theca cell ones. Two of these were those already reported by Melnick and Kantor. Kantor's specimen had with it the uterus which showed a marked endometrial hyperplasia. The other tumor, Barrett's, also from the Cook County Hospital, was not accompanied by the uterus, but in both cases the patients, who were past 60 years of age, had had metrorrhagias.

The third specimen I have studied was from the Presbyterian Hospital, a case of Dr. Edward Allen's. The patient was fifty-one years of age and had bled in excess during 1922 and 1923 when she was treated by radiotherapy for what was thought to be uterine fibroids. She had not bled since and the tumor proved to be a theca-celled one.

I have recently seen in the surgical laboratory at the County Hospital a hard ovarian tumor which proved to be an ordinary adenocarcinoma. The patient from whom this tumor was taken had given a positive reaction to the Friedman test prior to operation, for which reason it had been regarded as probable that the tumor was one of these hormone producing ones. This brings up the interesting point of preoperative hormone tests in our abdominopelvic tumors as one method of studying their characteristics.

I have a cut section of an endometrium which shows active menstrual reaction, obtained from a patient sixty-five years of age who had had her menopause fifteen years earlier. She had shown irregular bleeding, not quite as regular as three normal menstrual periods, but enough like to make her think that she was menstruating, as indeed this section shows she was. This patient was suffering from definite advanced carcinoma of the stomach, with bilateral tumors of the pelvis, the hard ovarian growth known as the Krukenberg tumor.

This brings up again the question as to whether such growths may not on occasion contain theca or granulosa cells. There is no ovarian tumor more mixed in its characteristics, in its cellular formation, and it is suggested that that portion of the tumor which is ordinarily regarded as sarcomatous may really be the granulosa or theca-celled type.

This further suggests, then, the hormonic study of all tumors of the pelvis in women. It would be well worth while to study these tumors from that point of view by preoperative physiologic examination, employing the Aschheim-Zondek or the Friedman test, as well as by the more recent "fish test" (bitterling) which seems to be a test of hormones rather than of pregnancy.

DR. EMIL NOVAK, BALTIMORE, MD.—The ideal plan for a discussion of such a subject as this would be for the group interested in gynecologic pathology to sit at microscopes and go over the specimens together. It is difficult to draw conclusions from a few slides thrown on the screen, especially when dealing with tumors

in which the examination of many slides from various parts is often essential for intelligent diagnosis.

So far as the pictures of the gross specimens are concerned, all of these tumors would seem to conform to the type of granulosa cell growth, with the possible exception of the third case, in which the tumor looks almost like a fibroma. It is not rare for granulosa cell tumors to be quite or almost solid, and to present the yellowish areas which Dr. Geist has stressed, although many, of course, present small or even very large cysts.

There is no tumor of the ovary which can assume a more varying microscopic picture than the granulosa cell cancer, as we have found in the study of more than 40 cases, and yet the diagnosis is in most cases relatively easy if one is familiar with these variations.

The chief motif of Dr. Geist's paper is the emphasis which he places upon the distinction between theca cell tumors and granulosa cell tumors, a distinction which does not seem to me justified. A study of undoubted granulosa cell tumors will often show areas exactly similar to those which have been shown on the screen as characterizing theca-cell growths. In one and the same tumor different areas may show a finely folliculoid pattern, a cylindromatous pattern, or a picture indistinguishable from sarcoma. Both granulosal and thecal cells arise from the same embryonic mesenchymal elements of the ovary, the corresponding tumors developing most often as frankly granulosal tumors, occasionally as theca cells tumors, often as intergrades or interminglings of the two types. I can see no good reason for designating the theca cell variety as a separate entity, any more than, for example, selecting the cylindroma for separate classification.

In laying such stress upon the nature and distribution of the lipoidal content of these tumors, Dr. Geist has emphasized what I think is a very unsubstantial criterion. One must remember that we are dealing with tumor cells of an embryonic rather than an adult type, and that the lipoidal content may thus undergo much modification, even if, as I do not believe is true, the lipoidal differences of the adult cells were established beyond question. To make what I think is a fair comparison, the normal squamous epithelium of the pars vaginalis is rich in glycogen, as shown by the Schiller technic. The cells of the cancer originating in this same epithelium, however, are lacking in glycogen. Again, there is a marked difference as regards lipoids in one and the same corpus luteum before and after menstruation.

The mere finding of estrin likewise is of no especial significance, as this substance is found in many body tissues, and, of course, in granulosa cell tumors. More important would be the study of the endometrium, and I wonder whether this was available in the third case, which grossly suggested the granulosa cell tumor less than any of the others.

My own reaction to the available evidence is that theca cell tumors are not to be considered a separate entity, but as simply a subdivision of the large group commonly included under the designation of granulosa cell tumors. A better name for the whole group would probably be progranulosa cell carcinoma.

DR. GEIST (Closing).—I cannot quite agree with Dr. Novak that the theca cell tumor is really a granulosa cell neoplasm. Given two types of cells the probabilities are that if these cells are capable of producing tumors we should have two types of tumors, and if this is so we should attempt to identify them as independent types. Dr. Novak spoke of the protean nature of these granulosa cell tumors—perhaps other tumor types are being classified in this granulosa cell group that really do not belong there.

I believe that there is a distinct difference between the granulosa cell tumor and the type I have demonstrated this morning. In none of the neoplasms termed theca cell tumors did careful histologic search reveal any areas typical of granulosa cell growths. The lipoid type and distribution I believe is important. The difference in distribution is very characteristic as has been mentioned by Schiller and demonstrated by me. The difference in type is also important. The main mass of lipoid in the granulosa cell tumor is phospholipoid; the main mass in the thecal tumor is cholesterol or cholesterol-ester.

Another point of differentiation is that the theca tumors are benign, while the granulosa cell tumor in many reported instances is definitely malignant.

In the second case the patient had a marked enlargement of her breast and profuse and irregular menstrual periods. The breast receded after removal of the tumor and the menstrual periods became absolutely normal, suggesting a hormonal influence. In the third case we did not get a specimen of the mucosa.

I do not think our criteria are sufficiently precise at the present time but I do believe that with more careful study we will be able to distinguish between these different tumor types. It may prove of some practical value to the surgeon when he opens the abdomen.

19. **Experience With Multiple Dose Roentgen Therapy in Malignant Diseases of the Uterus and Ovaries.** Dr. William P. Healy, New York, N. Y. (For original article, see page 613, November issue.)

DISCUSSION

DR. LEWIS C. SCHEFFEY, PHILADELPHIA, PA. (By invitation.).—I shall discuss the treatment of a series of cases of carcinoma of the cervix and the results obtained on the Gynecologic Ward Service at Jefferson Medical College Hospital, Philadelphia.

From 1921 until 1930, 155 patients were observed; of these 145 were treated, of which group over 95 per cent have been definitely followed up. The few untraced patients are, of course, regarded as dead. Too much emphasis cannot be placed on the desirability of a well-organized follow-up clinic, personally supervised by those administering the treatment.

Based on the Schmitz classification, in only 11.6 per cent of the patients seen has the carcinoma been thought to be limited to the cervix.

Of the 155 patients observed, in the period mentioned, 29 are alive from five to twelve years, 18.7 per cent absolute. Considering those patients treated (145) the percentage alive amounts to 20, while in addition 7 patients survived for six to eight years after their initial treatment, increasing the five-year salvage to 24.8 per cent. One patient died as an immediate result of treatment, a mortality of 0.068 per cent.

When the result of treatment of our early cases, Class I and II, is considered, 18 were observed and treated of whom 7 are alive five to twelve years, 38.8 per cent, while three patients survived from six to eight years after treatment, making the five-year salvage 55.5 per cent.

A word as to treatment: 80 per cent (118 patients) received radium applications only; 19 received x-ray subsequently; 3 were treated solely with the x-ray, while in only 5 patients was panhysterectomy resorted to, with adjuvant radiation, either as a preliminary or postoperative measure or both. Analysis of this phase of our report is enlightening but time does not permit a detailed discussion.

As noted, x-ray therapy was employed infrequently in this series, for in the earlier days its use discouraged us in certain instances, possibly because a massive dose technic, completed in three or four days, was used.

More recently we have been utilizing the multiple dose method, similar in principle to that recommended by Dr. Healy, both prior to and following the use of radium. Evaluation of this altered technic is obviously impossible as yet, but we feel that the results just tabulated will be a valuable control for future comparisons as to the efficacy of the present plan.

DR. NELSON B. SACKETT, NEW YORK CITY (By invitation).—The results from the Woman's Hospital are roughly the same as those reported by Mr. Bonney, namely: of unselected patients 1 out of 4 may be expected to survive five years or more; and 1 out of 6, about 18 per cent, may be expected to survive ten years or more. These results can be roughly doubled in the Schmitz Class I and II cases, indicating that we may hope for marked improvement by cancer propaganda resulting in early detection of cases.

That that propaganda has so far been disappointing is indicated by our experience at the Woman's Hospital, for in the first eight years of radium treatment the percentage of Schmitz Class I and II cases was roughly 21 and a fraction, whereas in the past seven years it is even lower, 18 per cent.

While we cannot estimate the results of adjuvant roentgen therapy until about 1938, since it was not given in satisfactory doses until 1933, our five-year survival rate can be expected to improve possibly 5 or 6 per cent, judging from the improvement obtained by Regaud in Paris. At the same time the total salvage by radiation therapy is not likely to be more than 35 per cent by any of those methods. Therefore it would seem that we must fall back upon prophylaxis as emphasized by Dr. Barrett at the American Medical Association last year and as formerly emphasized by the reports from Graves's Clinic.

While we talk about the salvage of life, we must remember that the patient's health after treatment is equally important or more important to herself and to her family. I think similar studies should be submitted on patients surgically treated and untreated, so that we may properly estimate whether it is worth while to give a woman with cancer of the cervix irradiation. Except for hemorrhage, which is part and parcel of cancer of the cervix, none of the complications referred to occurred in as many as 10 per cent. Roughly one-third of the pyometra cases had this complication on admission. While there are almost 10 per cent of bladder and urethral complications, many of those are very trivial and transient.

If we confine ourselves to the late bladder reaction, the figure is near 3 per cent, or comparable to that reported by Dr. Dean from the Memorial Hospital.

If we are going to differentiate the effect of the radiation from the effect of the disease itself, we should take the whole series of patients and compare them with those patients who are destined to survive.

I have tabled the percentages of complications in 638 cases at the Woman's Hospital in patients who have survived five years. There were 127 five-year cases which had complications and, with two exceptions, they are all less in the group of patients destined to survive irradiation than in the whole group, three-fourths of whom are destined to die of the disease itself. In the ten-year series the same is true.

The minus marks bring out that these figures are in every case much less than the percentages figured on patients who die of cancer, and still far less than patients untreated. A notable exception is lymphatic obstruction. Patients with varicose veins and ulcers and marked edema seem to be more frequent among the five-year survivors than in the total group; and therefore the irradiation effect

would seem to be implicated. Likewise they occur over twice as frequently in the group that has survived ten years or more. Further, in most of these patients the symptoms are transient and can be cured by elevation, massage, etc., indicating that they are effects of radiation and not of the cancer.

From the study of these complications it seemed to us that the complications came more frequently in untreated, hopeless cases, that they were less frequent in patients destined to survive than in the entire series, and that except for hemorrhage each complication occurs in less than 10 per cent of all patients treated; also that complications most often appear within a few weeks or months of death from metastases and that their appearance is of unfavorable prognostic import. Carcinoma of the stump occurred in 7 per cent of our series, and the incidence of fistula in stump cases was 12 per cent or one and one-half times the general fistula incidence.

DR. NORMAN F. MILLER, ANN ARBOR, MICH.—When such potent therapy is extended as Dr. Healy has advocated and used to full capacity, additional hazards to the patient may be expected. In a review of our own group treated very similarly to the method described we found nine patients with a fracture of the neck of the femur. Two of these showed obvious x-ray evidence of metastases. In seven there was no x-ray evidence of metastatic growth. One patient has been observed for a period of sixteen months without x-ray evidence of neoplastic involvement in the fractured hip. Two were quite ill with this hip involvement but are now able to walk. We cannot be dogmatic but the question as to whether therapy produces a trophic change (osteoporosis) must be seriously considered. The blood supply to the neck of the femur, through the ligimentum teres, is not beyond injury from the intensive remedial measures used in the treatment of cervical cancer.

DR. WALTER T. DANNREUTHER, NEW YORK CITY.—Dr. Healy has sharply differentiated between the massive unit dose and the cumulative dose of roentgen ray therapy. I have used the latter method for the past year and one-half in the treatment of carcinoma of the cervix, but up to the present time the roentgen ray therapy has been applied after the radium applications. It is quite evident from Dr. Healy's enlightening presentation that I have made a mistake by starting the cumulative x-ray immediately after the radium therapy.

Two things have impressed me in contrasting the modified Coutard method with the one previously employed; when the massive unit doses were given, using four portals of entry, the patients suffered a great deal from nausea and temporary prostration, although if they were in reasonably good condition the unpleasant symptoms soon disappeared. On the other hand, the patients treated with cumulative doses have been distressed by severe proctitis, diarrhea, intestinal hemorrhage, and discomfort in the descending colon. The likelihood of intestinal disturbance and skin destruction, stressed by Dr. Healy, cannot be too strongly emphasized. I have had a rather discouraging experience in several cases particularly, in which there was not only intense tenesmus in the colon, but also profuse bleeding.

The second thing that is striking about the cumulative dosage is that the prostration is greatly prolonged.

I recently had a patient who was subjected to the Wertheim operation, which was promptly followed by roentgen ray therapy, given daily for thirty days. Dr. Miller's suggestion that osteoporosis or osteosclerosis may result from cumulative doses is very illuminating because this patient was found to have a pathologic fracture of the neck of the right femur, without a fall or any noticeable strain of the joint. Repeated monthly x-ray pictures have shown nothing but a definite loss

of calcium in the bone. (In June, 1935, this patient sustained a pathologic fracture of the neck of the other femur, again without forcible trauma or evidence of metastasis.)

DR. KARL H. MARTZLOFF, PORTLAND, ORE.—Since a modified adaptation of the Coutard technic is probably coming into more or less general use it seems to me that we are going to see, in addition to what Dr. Miller has described, another type of late complication which will give us occasion for serious thought. Dr. Healy, I believe, just as Dr. Coutard, aims to produce an area of definite superficial skin necrosis in order that he may know that a dosage of maximum tolerance has been given. This has been termed radioepidermitis or epithelitis. I do not believe this skin change, although it appears superficial, is altogether innocuous, for it indicates that underlying vasculoconnective tissue changes are also in progress with varying degrees of endarteritis. In some individuals these changes probably are slowly progressive for years so that a patient may develop a large area of necrosis of skin and subcutaneous tissue three or four years after completion of radiation therapy. Now it is this and allied complications which the Coutard method aims to avoid by the protracted use of small daily doses of roentgen ray. The long-drawn-out period of treatment varying from forty to seventy days is one of the immediate disadvantageous aspects of Coutard's method and will probably lead to modifications whose actual effects, harmful and otherwise, may not be appreciated for several years. Therefore, I am afraid we shall see more of those cases as time goes on and I would like to ask Dr. Healy what his experience has been with this complication. Also, does he think that the unmodified employment of the Coutard procedure will actually obviate such complications?

DR. HEALY (Closing).—Dr. Dannreuther and Dr. Miller brought out the facts referred to in this paper, the great danger and the ultimate damage that may result from heavy intensive irradiation of normal tissues. I have been using roentgen ray therapy at the Memorial Hospital for fourteen years as a routine procedure and it has been a fairly constant observation in my private patients, whom I see and study closely, that in the second year following treatment in a fairly large number of the cases there will be a small area, the size of the palm of one's hand, on one or the other side in which telangiectatic changes will be observable in the skin and a brawny subcutaneous area in the fat. Why in that one area? Why not in other areas which have received the same amount of radiation? Last year I published a paper on the roentgen and radium complications. I have done six or seven celiotomies with bowel resection for radiation damage to the intestine, the condition coming on a year or a year and a half after radiation with radium and roentgen ray as we were then using it. Now we are trying to increase the dose but you must select your cases. You cannot take a debilitated person and give her this kind of treatment, and it places upon the gynecologist and the roentgenologist a big responsibility to keep their patients under close observation during the course of treatment. I do not know how much more we shall have in the way of serious complications in two to five years after this form of therapy than we have previously had. It is probable that we will have a few more bladder lesions. Undoubtedly we will have some intestinal complications that may result in gangrene and require a resection, but if we do not have too many and if we can improve our percentage of end-results it may be worth while; or it may be that when we have finished all this effort we will find that we have about reached our maximum and cannot do more with combined roentgen and radium radiation than with radium alone. Dr. Coutard has done better and he is the only one who has developed this plan of treatment.

WASHINGTON GYNECOLOGICAL SOCIETY

MEETING OF NOVEMBER 24, 1934

The following papers were presented:

Embryonal Cysts of the Cervix and Their Etiology, With a Report of Two Cases. Dr. J. Kotz. (For original article, see page 854.)

A Case of Bicornate Uterus With Double Cervix and Vagina, Premature Separation of the Placenta, Excision of Vaginal and Cervical Septa Followed by Delivery of a Living Child. Dr. A. E. Pagan.

Fibroids Complicated by Pregnancy: Aschheim-Zondek Reaction: Hysterectomy. Dr. H. P. Ramsey.

Item

An Enlarged Journal

The constantly increasing demands for space in the JOURNAL make it necessary to provide an additional number of pages. Beginning with the January issue, a total of about 200 pages will be added to each volume, or approximately 400 each year. This increase in size will avoid some of the previously unavoidable delays in the publication of accepted papers and permit the expansion of certain departments, including those devoted to reviews, abstracts, and "maternal welfare." The publication of the dicussions of papers read at the meetings of societies of which the JOURNAL is the official organ will also be resumed so far as this is practical. It is hoped by these additions to provide for more adequate and prompt appearance of the contributions of American authors in the special field represented by the JOURNAL and thus add to its value for those who have supported the publication by their subscriptions. A more detailed announcement of policies will appear in the January issue.

The Editors.

Department of Reviews and Abstracts

Conducted by Hugo Ehrenfest, M.D.

Selected Abstracts

Organotherapy

Dodds, E. C.: Oestrus-Producing Hormones, Brit. M. J. 2: 1187, 1934.

Three estrus-producing hormones have been identified in the urine of pregnant women. They belong to the group of sterols, and have in common a partially hydrogenated phenanthrene ring.

The type of estrin in the circulating blood, the ovary or the placenta is unknown. Plants contain an estrus-producing substance, of same structure as estrin, named tokokinin. Vitamin D in very large doses produces estrus. Estrus-producing hormones are found linked closely with carcinogenic substances, and with vitamins and plant sterols.

Kaufmann's demonstration that menstruation can be produced in ovariectomized women by administering sufficient estrus-producing hormone and corpus luteum hormone was confirmed by the author. The former also showed that *large* doses of the hormones can produce pathologic conditions of the endometrium, i.e., cystic hyperplasia. This points to a therapeutic value in these hormones and opens a practical application for them in many gynecologic conditions hitherto treated by surgery only.

F. L. Adair and S. A. Pearl.

Buschbeck: Progress in Gynecologic Hormone Therapy, Monatschr. f. Geburtsh. u. Gynäk. 98: 123, 1934.

The basis of modern hormone therapy lies in the present knowledge of the "normal dosages" which in the Women's Clinics of Berlin and Wuerzburg have been established on female castrates. A true menstrual flow is obtained with not less than 200,000 to 300,000 M.U. of follicle hormone (progynon B) and 100 clinical units of corpus luteum hormone (proluton). The writer reports 36 successes on castrated women with these doses. No failure. The corpus luteum hormone must be injected within eight days after the last progynon injection. Between 20,000 and 50,000 M.U. of progynon must be administered during the first half of the cycle.

With progynon alone in 24 cases of secondary amenorrhea menstruation-like flows were obtained, which in four cases by curettage were shown to be not true menstruations.

In a sterile woman, amenorrheic for two years, two series of injections of 100,000 units of progynon led to one flow each time and then were followed by a pregnancy.

It is impossible to say whether the therapy improved possibility of nidation or resulted in expulsion of a mature ovum. This one experience could encourage such therapy for certain cases of sterility.

In one case each of very severe pruritus and kraurosis vulva one menstruation-like flow (in climacterium) each followed the injection of 1,100,000 M.U. of progynon B.

HUGO EHRENFEST.

Loeser, Alfred: Artificial Production of Menstruation with Ovarian Hormones in Cases of Primary and Secondary Amenorrhoea, J. Obst. & Gynec. Brit. Emp. **41:** 86, 1934.

The author has succeeded in producing normal menstruation in three out of five women with primary amenorrhea by giving 300,000 mouse units of a preparation of follicular hormone followed by injections of a corpus luteum hormone. The women, aged twenty-five, thirty, and thirty-eight, had never before had any genital bleeding. In each case the uterus, which was small and atrophic, increased to 5 to 7 cm. in length. The treatment was as follows: first day, 100,000 M.U.; seventh day, 100,000 M.U.; fourteenth day, 50,000 M.U.; nineteenth day, 50,000 M.U., of the follicular hormone. From the twenty-second to the twenty-sixth day inclusive, 10 rabbit units each day of corpus luteum hormone was given. Unfortunately, women subjected to this treatment menstruate only once. In general a treatment for months is necessary to produce the bleeding repeatedly at the term desired.

WILLIAM F. MENGERT.

Buschbeck, H.: Progress in Gynecological Hormone Therapy, Monatschr. f. Geburtsh. u. Gynäk. **98:** 344, 1935.

It has been shown that in completely castrated women a true menstrual flow can be effected by administering first follicular and then corpus luteum hormone. The same treatment may be used in women who have amenorrhea. The author has produced fifty menstrual periods and has thus far not encountered a single failure. He insists that large doses of both substances must be used and that the corpus luteum hormone must be given not later than eight days after the last injection of follicle hormone. The intensity of the bleeding depends upon the amount of follicle hormone and not upon the corpus luteum hormone. This information is utilized by giving women who have slight menstrual bleeding, large doses of follicle fluid during the first half of the menstrual cycle.

The results with this form of hormone treatment of dysmenorrhea are striking. The author has seen patients relieved of their pain after one injection. He has improved the regularity of menstrual cycles in women whose menses are too infrequent by the injection of follicle hormone. He has likewise obtained excellent results in cases of secondary amenorrhea, and points out that he has observed good results with follicle fluid alone. However, curettement in such cases failed to show the typical premenstrual growth of the endometrium. Hence, these bleedings are not true menstruation.

J. P. GREENHILL.

Murphy, Douglas P.; Shoemaker, Rosemary; and Rea, Marion: Menstrual Response to Luteinizing Extract of Pregnant Urine, Endocrinology **18:** 203, 1934.

Luteinizing extracts of pregnancy urine injected hypodermically in five normal women, over a ten-day period beginning with the first day of the menstrual flow, was followed by no significant alteration in either subjective symptoms or blood

flow during the coexisting or two subsequent menstruations. Of five women similarly treated except that the injections were administered on a day midway between the two menses, three experienced entirely new symptoms of a painful nature, and one other subject had an eight-day period of spotting at the end of a normal three- to four-day menstrual flow.

J. THORNWELL WITHERSPOON.

Brochier, A.: The Use of Follicular Hormone in Premature Infants, Bull. Soc. d'obst et de gynéc. **23**: 542, 1934.

Brochier systematically employed folliculin in doses of 1,000 International units in premature infants. Not one of the children so treated died, whereas premature infants of about the same weight and development and born under the same conditions had a high incidence of death. A remarkable fact was that the infants treated with folliculin lost only a small amount of weight and began to gain after the second day. On the other hand, the untreated babies lost a great deal of weight and did not begin to gain until after the third day.

J. P. GREENHILL.

Macchiarulo, O.: The Influence of Ovarian Preparations Upon the General Development of Fetuses at Term, Folia gynaec. **31**: 1, 1934.

The author found that folliculin administered to a group of pregnant guinea pigs brought about a healthier and better developed litter. The experiment was undertaken following Schiller's work on the beneficial effects of folliculin on premature infants.

MARIO A. CASTALLO.

Sure, J. H.: Endocrine Headaches, Wisconsin M. J. **33**: 671, 1934.

The type of endocrine headaches varies. They may be periodical, that is, pre- or postmenstrual, and are only occasionally continual. They may be hemicranial, temporal, parietal, or occipital. They may be sufficient to incapacitate the patient, or may only be annoying. It is described as compressing or expanding. The author offers the following classification as a cause for the headache: (1) Hypergonadism, (a) hyperestrinemia, (b) hyperprolanemia A; (2) hypogonadism, (a) hypoestrinemia, (b) hypoprolanemia A; (3) hyper- and hypolutemia; (4) hyper- and hypoprolanemia B; (5) hypo- and hyperthyroidism; (6) hyper- and hypopituitarism; (7) hyper- and hypoadrenalism.

J. THORNWELL WITHERSPOON.

Skipp, W. M.: Pituitary Headache, Endocrinology **18**: 596, 1934.

Eleven patients suffering from pituitary headache (10 females and 1 male) were treated with posterior pituitary extract by mouth and subcutaneously, with disappearance of the headaches. Posterior lobe extract in tablet form was given orally and infundin hypodermically. The case histories of three of the patients are given in detail. Extracts of the anterior lobe were apparently without benefit.

J. THORNWELL WITHERSPOON.

Borovskaja, V. A.: Clinical Observation on Hypophysectomized Patients, Vestnik Endocrinologii (Moskow) **4**: 374, 1934.

The author studying hypophysectomized patients found in all cases without exception extreme psychical slothfulness, somnolence, increasing corpulency, motor slow-

ness, and sharp decline of sexual sensitiveness. Return of vision is usually slight, in some cases vision was not restored. Headaches in the majority of cases became noticeably lessened. These complications were treated with hypophyseal hormones, or continuous injections of Gravidan (sterile urine from six to eight weeks' pregnancy), or by repeated implantations of the pituitary gland. The author doubts the necessity of hypophysectomy, except in suspected malignancy of the pituitary gland, because this operation leads to new forms of diseases.

ALEXANDER GABRIELIANZ.

Stern, D. M.: The Zondek-Aschheim Test After Partial Hypophysectomy, Proc. Roy. Soc. Med. London **27**: 1501, 1934.

In July, 1931, the then twenty-one-year-old patient was admitted for signs of acromegaly, bitemporal hemianopia of scotomatous type. Skiagram showed enlarged sella turcica. A few days later a large part of the anterior pituitary body was extirpated, an adenomatous growth.

A year later she married, and in September, 1932, realized that she was pregnant. The Aschheim-Zondek reaction was found positive. She passed through a normal pregnancy and was delivered in January, 1933, of a 7½-pound normal baby.

The concentration of gonadotropic hormones was definitely below normal. The reaction was negative six weeks postpartum.

It remains an open question whether these hormones were derived from the small fragment of remaining anterior pituitary body or had some other source, such as embryonic trophoblast.

HUGO EHRENFEST.

Arapoff, D. A.: Homotransplantation, as a Method of Treatment of Endocrinopathies, Vestnik Endocrinologii (Moskow) **4**: 439, 1934.

In the treatment of certain endocrinopathies (such as cretinism, eunuchoidism, sexual impotence in men, hypofunction of the ovary), the author, in 67 cases, used transplantations of thyroid gland, testicle and ovaries from human beings who had died from accidents. Glands were taken from the corpse one to six hours after death, were preserved in physiologic saline solution and kept on ice, until the results from Wassermann reaction were known. Glands were implanted in subcutaneous tissue of abdomen or breast. In fifteen cases of transplantation of testicle the method of Voronoff was used. Permission for performing the autopsy for the removal of required glands was granted by the Prosecuting Attorney in 1931.

For transplantation of the hypophysis the gland of calf embryo, monkey, sheep, pig, and goat was used. The human hypophysis was difficult to remove. The most favorable results were obtained with thyroid gland implants.

ALEXANDER GABRIELIANZ.

Allen, E., Gardner, W. V., and Diddle, A. W.: Experiments with Theelin and Galactin on Growth and Function of the Mammary Glands of the Monkey, Endocrinology **19**: 305, 1935.

Ten Macacus monkeys weighing from 3,365 to 6,050 gm. and at various stages of sexual maturity were injected with galactin, or prolactin, with or without previous theelin treatment. Lactation was induced in four mature animals and in one animal just reaching sexual maturity, following the injections of six to nine rabbit units of galactin or prolactin. Three of the mature animals possessed one

or both ovaries; the other two were ovariectomized. The two ovariectomized animals had been previously injected with 2,150 and 1,700 R.U. of theelin. Treatment with galactin was begun in three of the above normal animals on the third, fifteenth, and twentieth days, respectively, of the menstrual cycle.

The lactation-stimulating hormone in doses from 3 to 13 rabbit units did not induce lactation in the remaining 5 animals, 3 of which were just reaching maturity and 2 of which were immature. From 1,300 to 1,700 R.U. of theelin were injected in all cases before beginning galactin treatment.

All of the monkeys with mature mammary glands responded positively to galactin in the doses and over the interval given. Partially developed mammary glands of younger monkeys did not respond.

J. THORNWELL WITHERSPOON.

Kabak, A. M., and Kizelshtein, M. S.: Endocrine Factors of Lactation, Vestnik Endocrinologii (Moskow) **4:** 460, 1934.

The authors analyze the results of the injections of different hormones in 60 sheep. Another fifteen sheep were taken as control. (1) The urine from women in the middle of pregnancy was injected daily into the sheep during fifteen consecutive days (from 10 c.c. to 22 c.c. daily). The lactation was suppressed. (2) The alkaline extract of the hypophysis injected the same length of time, 22 c.c. daily, did not give changes in the quantity of milk. Smaller doses (5 c.c.) gave an increase in milk only during the experiment. (3) Prolan at the time of the experiment suppressed lactation, but when three injections (300 M.U. daily) were given a notable rise in the lactation curve occurred, surpassing the control sheep in the long period of observation (twenty-two days).

ALEXANDER GABRIELIANZ.

Jeffcoate, T. N. A.: Sterility Due to Ovarian Dysfunction, Brit. M. J. **1:** 345, 1935.

The author presents the view that sterility, in patients with no menstrual upset and no abnormalities of organs, is due to the absence of ovulation. Anovular menstruation is frequent. It is a serious factor in sterility. It accounts for the majority of cases in which menstrual upset is an additional symptom. It is responsible for unsuccessful results in the treatment of some obvious lesions, anteflexion or retroversion. Failure of follicular rupture explains the physiologic sterility in early life and late middle ages. Anovular menstruation is most frequent at these periods. Sterility associated with neoplasms is not the result of these tumors: both conditions are manifestations of a primary ovarian disorder.

F. L. ADAIR AND S. A. PEARL.

Hamblen, E. C.: Results of Preoperative Administration of an Extract of Pregnancy Urine: A Study of the Ovaries and of the Endometria in Hyperplasia of the Endometrium Following Such Administration, Endocrinology **19:** 169, 1935.

A study of the ovaries and of the endometria of eleven patients with hyperplasia of the endometrium following injections of an APL extract is presented. Single injections ranged from 100 to 400 R.U.; the frequency of administration varied from one to four times daily, while the duration of treatment was from four to nine days and the total dosage from 2,400 to 8,200 R.U. Patients with gross inflammatory changes or with benign or malignant tumors of the generative tract were not studied. Endometrial specimens were obtained before administration of the extract and after its injection, with corresponding ovarian specimens.

These experiments showed that APL extract does not affect primordial or early follicles and that it acts primarily upon maturing or mature ones, increasing the degenerative changes commonly observed and probably producing cystic degeneration. In a mature group of patients with hyperplasia, however, APL extract apparently produced recent corpora lutea. This observation was not noted in an immature group of patients, also exhibiting hyperplasia of the endometrium. Hemorrhage into or about follicles was considered an unimportant finding, while endometrial changes were produced in only one instance.

J. THORNWELL WITHERSPOON.

Cornil, L., and Escarras, A.: Experimental Researches on the Gonadotropic Hormone in Uterine Epithelioma, Endocrinol. e patol. costit. **3:** 208, 1934.

In twenty-five cases of cervical epithelioma the authors found the Friedman test positive in thirteen cases; of these, ten were of the predominating basal cell type. The test was doubtful seven times of which four cases were of the predominating spindle cell type. It was negative five times; four cases were of the spindle cell type. In ten cases of extragenital epithelioma (eight in women and two in men) there was only one doubtful positive Friedman test; the remaining nine gave a negative test.

MARIO A. CASTALLO.

Umezawa, R.: Melanocyte Reaction of Preparations of the Pituitary Body and the Urine of Cancer Patients, Jap. J. Obst. & Gynec. **18:** 2, 1934.

Umezawa found that he could produce a strongly positive melanocyte reaction not only by the injection of preparations of the posterior pituitary lobe, but also by the administration of anterior lobe preparations, and the so-called anterior pituitary hormones. He found that cancer patients excrete the melanocyte hormone in their urine. Judging from this occurrence the author believes that cancer and pituitary secretions have an intimate relationship. Since he noticed that a positive melanocyte reaction can be found only in the urine of cancer patients, he believes that this reaction can be employed for the immediate diagnosis of cancer.

J. P. GREENHILL.

Magistris, H.: Antihormonal Sterilization of Female Animals. (1) By Preparations from Male Sexual Glands, Rev. Soc. Argent. de biol. **10:** 179, 1934.

The author prepared testicular substance according to the method of Neumann. He injected various amounts of this preparation into female white mice and obtained temporary sterilization of the animals. The smaller amounts, using two to four testicles of male white mice, did not produce sterilization in the female. Large amounts, twelve to fourteen testicles, in some cases caused death. A medium amount, eight to twelve testicles in solution, gave the best results.

MARIO A. CASTALLO.

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